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# *ORIGINAL ARTICLES*

## CASE INDICATIONS FOR THE USE OF SOME OF THE MORE EFFICIENT FORMS OF APPLIANCES*

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THE belief that a careful consideration of some of the more efficient and simple forms of orthodontic appliances, with a view to standardizing the use of these appliances according to the case indications or to the movement of teeth and development of the bones of the jaws and face which must be secured in order to treat the various forms of malocclusion successfully, will be of value to orthodontists, to the dental profession, and to the public, is the excuse for this paper.

Some of the reasons why standardization of the use of the more efficient forms of orthodontic appliances according to the tooth movements to be gained in order to secure normal occlusion of the teeth and normal development of the associated tissues, in short, an ideal result, are: that the form or forms of appliances used to treat a case may possess in the maximum degree the qualities of efficiency and simplicity so that the active period or periods of treatment may be "speeded up" as rapidly as safety to the tissues involved will permit, with the smallest degree of discomfort to the patient, and with the minimum expenditure of time on the part of the operator; all to the end that the final result, the result years after all retainers have been removed, will be an individual, normal at least in the dentofacial area.

Another reason experienced orthodontists should standardize their methods of treatment is so the younger and less experienced, who are beginning to practice orthodontia, may have a guide toward the goal of more efficient methods of treatment, that they may more readily acquire the knowl-

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edge which has been gained by the experienced orthodontist through many years of intensive application. The need is all the more acute; for the beginner, necessarily lacking in experience, has his mind distracted by the claims made for each of the many forms of appliances, the manufacturer or the advocate of each type making claims for these appliances which will prove to be greatly exaggerated. The business of the manufacturer of a regulating appliance is to sell that appliance,—hence, the alluring advertisements appealing to the greed of the dentist. He never forgets to emphasize the supposed ease with which malocclusions of the teeth may be corrected through the use of that appliance. One manufacturer of regulating appliances states that "The * * * method of correction enables every practitioner to approach malocclusion confidently. It is simple, safe, easily understood and profitable. With an hour's study you can fit yourself for your first case." Again he states, "This method is simple, thoroughly practical, and easily within the grasp of every general practitioner. Each case requires only a few minutes once or twice a week for adjusting. We furnish a removable appliance fitted for each case. All you have to do is to regulate the appliance as the case develops."

Could anything be more misleading? Could we think of anything better calculated to draw the dollars from the pockets of the dentist, who is in ignorance of the science of orthodontia, and to fill the coffers of the appliance manufacturer? And yet the Journal of the American Dental Association carries such an advertisement. The inference is that the use of this appliance in the hands of the rank and file of the dental profession is approved by the officers of the American Dental Association. Why does this state of affairs exist? The answer is, lack of knowledge, first, of the normal occlusion of the teeth; second, of the variations from normal which go to make up the different classes of malocclusion; third, of the etiology of malocclusion; fourth, of the ideal for which the dentist attempting to treat cases of malocclusion must strive.

What are the dentists accomplishing who are attempting to treat cases of malocclusion without adequate knowledge of the causes; without adequate training in technic; whose idea in listening to the alluring words of the appliance manufacturer is that they may increase their income? What are the results? The results are, that after a few futile experiments the majority give up in disgust; for they find that their more or less complete failures in the attempt to treat malocclusions have discredited all their work in the eyes of many of their patients. They have also discovered that the same amount of time and energy devoted to those branches of dentistry with which they are more familiar, brings greater financial return. What is the excuse for the existence of the dental profession? Is it not that we may benefit the public? Most assuredly the public is not benefited by orthodontic operations carried on as outlined. What would these men think of the physician who would attempt to operate upon one of their little patients for tonsillectomy or appendectomy without first having received adequate postgraduate instruction? Who would attempt to operate under instructions from

the surgical instrument manufacturer who sold the instruments with which to perform the operation? Yet these men are just as culpable. I am sorry to note that even some of our orthodontia postgraduate course advertisements may lead the general practitioner to think that orthodontic knowledge is acquired without much study; that even a short course in technic may enable him to treat orthodontia cases successfully, instead of emphasizing the importance of acquiring a thorough knowledge of the subject so that children suffering from malocclusion may receive the wonderful benefit which is to be derived from an intelligent diagnosis and then the skillful application of the proper treatment.

To secure these results orthodontists have at their command a few efficient forms of appliances, each one of which possesses valuable features not found to as great a degree in the other. Foremost among these are:

1. The expansion arch.
2. The lingual appliance.
3. The ribbon-arch and bracket-band appliance, or its predecessor, the pin-and-tube appliance.
4. The small diameter, round, labial arch used with anterior bands carrying hooks for reception of arch.
5. For retention or the passive period of treatment and for simple tooth movements, the "Hawley" development of the retaining plate.

In considering each of these forms of appliances to best secure certain tooth movements, as John Mershon has said, "The 'Why' must have precedence over the 'How' "; otherwise, force will not be intelligently applied. In studying the different types of appliances mentioned, we will consider their weak points as well as their strong. The description of each appliance must be brief; reference to a more detailed description may be found at the end of this paper.

## THE EXPANSION ARCH

The appliance most valuable to the beginner in orthodontia is the old expansion arch, because it possesses the quality of simplicity, and also has the quality of efficiency to a high enough degree to enable the operator to treat many cases of malocclusion with a fair degree of success. As we all know, the expansion arch is a form made from an elastic wire placed in a horizontal plane around the outer surfaces of the teeth, and engaging horizontal tubes attached to bands upon the anchor teeth, which are usually the first permanent molars. The wire arch is gradually shaped to the ideal form which the teeth are to assume when the malocclusion is corrected, the teeth being moved toward this arch through the medium of ligatures usually augmented by bands with spurs upon those teeth which need rotation. This arch form is efficient when intelligently applied to the simpler cases. It, however, has the disadvantage of bulk and of liability to irritation of the gums around the necks of the teeth from the ligatures, also irritation of the lips and cheeks, even when the arch is bent at the beginning of treatment so close to the teeth that only space is left for a small amount of tooth movement. It also has the disadvantages of necessitating more frequent inspection and adjustments from

the operator than other forms of appliances mentioned, also of requiring prophylaxis more frequently. It has a weak point which is common to all appliances in that the utmost care must be exercised to so align the arch with the buccal tubes that the anchor teeth are not tipped, twisted, elevated or depressed in any direction except toward that of normal position.[1, 2, 3]

### THE LINGUAL APPLIANCE

Next we have the lingual appliance which, as developed by John Mershon and also by J. Lowe Young (in the "Angle-Young" lock) and others, has many advantages over the expansion arch. This appliance has the advantage of stimulating normal arch development, through gentle spring pressure applied to the lingual surfaces of the teeth, leaving the labial surfaces free for the influence of the muscle action of the lips. It has great advantages on account of not interfering with efficient prophylactic measures where the labial gingival gum tissues are inflamed or hypertrophied. It may often be used under these conditions at the beginning of treatment to secure expansion and then later an appliance for moving the roots of the teeth may be used. It has the disadvantage in the hands of the inexperienced of being more difficult to apply efficiently than the expansion arch. Also if treatment is crowded, there is greater danger of tipping the anchor teeth in the wrong direction, for if too great a force is applied against the anterior teeth there is a reciprocal force exerted through the long leverage of the arch extending backward from the anterior teeth to the molar anchorage. This may be largely overcome along with the tendency which some patients have of moving the arch towards the incisal ends of the teeth with the tongue, by ligating to some of the anterior teeth, or by placing a band carrying rotating spur upon a tooth which needs rotation and then ligating to the auxiliary springs instead of to the arch. A lingual spur extending over the arch may also be attached to band, thus materially aiding in keeping the arch in place. I should also mention that the Angle-Young lock is efficient when used to correct the position of badly rotated and tipped molars.[4, 5]

### THE RIBBON-ARCH AND BRACKET-BAND APPLIANCE, AND ITS PREDECESSOR, THE PIN-AND-TUBE

The ribbon-arch and bracket-band appliance as developed by Edward H. Angle, possesses great advantages over all other forms of appliances in moving in the most efficient manner the roots of teeth through gentle spring pressure so as to stimulate development of the associated bones. This is a tooth movement and a bone development which must be secured in many cases if we are to have permanent results. This appliance has the advantage over the expansion arch in less interference with prophylactic care of the teeth, also in the elimination of ligatures which may irritate the gums. It has the disadvantage of being a safe and efficient appliance only when in the hands of the orthodontist who has technical ability of the highest order and whose understanding of the "Why's" is highly developed. In the hands of such an operator it is not a difficult appliance to apply to the teeth and then adjust for efficient tooth movement. However, in comparison with the two appli-

ances first considered, it is not easily and quickly applied, but it has such valuable qualities that the skilled orthodontist can in cases, where indicated, accomplish better results for his patients with greater ease and in less time than with any other appliance of which I know.[6, 7]

All arches which are attached to incisor bands through a locking device upon labial surface of the band have a tendency to cause loosening of the band upon the lingual side of the incisor; therefore, great care on the part of the operator is necessary. In making the incisor bands it is best to reinforce the lingual surfaces with a little solder, and then to use utmost care and skill in adjusting the appliance in order to shorten the period of active treatment so that these bands may be removed and danger to the tooth lessened. The rigid holding of several teeth by the appliance, thereby preventing individual movement, is another reason for its early removal.

Another advantage possessed by the ribbon-arch and bracket-band appliance is that the resistance afforded by several anterior teeth being rigidly fastened together by the arch and the locking device upon the bands, gives sufficient stationary anchorage; so that in case it is desired to close a space caused by the absence of a molar or premolar, a plain arch-end of round wire running through a plain tube horizontally placed upon the banded tooth which is to be moved forward, may be employed, and the posterior teeth moved forward in upright position, with the minimum amount of danger of causing lingual tipping of the anterior teeth.

The following case illustrates the use of the ribbon-arch and bracket-band appliance under these conditions. See first models in Figs. 1, 2 and 3. The maxillary incisors have a slight lingual retrusion; they are also crowded and rotated, while the mandibular arch has collapsed upon the left side due to the loss of the first permanent molar. As a consequence, the second molar upon that side has tipped forward and rotated, see first model in Fig. 3. The right mandibular first permanent molar has a vital pulp, but the crown was badly decayed and carried a large amalgam filling. The maxillary first permanent molars were pulpless, and radiograms showed areas of rarefaction. Extraction of these three first permanent molars was decided upon. Then bracket-bands were placed upon the six maxillary anterior teeth, and also upon the six mandibular anterior teeth. Upon the maxillary and the right mandibular second molars were placed plain bands, to the buccal surfaces of which were attached horizontal tubes for the reception of smooth .036 diameter wire arch-ends. These were soldered to the anterior section of ribbon-arch wire, these arch-ends accurately fitting their molar band tubes so that when forward movement of the second molars was inaugurated through the use of rubber ligatures, the molars would move forward in upright position. The left mandibular second molar carried a plain band with a short perpendicularly placed round tube on its mesiobuccal angle. This was for the reception of the Young lock which was to be used to rotate this tooth while tipping it into upright position. The Young lock was made of .030 spring wire. Rotation was accomplished through bending the posterior portion of the lock against the distobuccal angle of the band, thus exerting pres-

sure inward in this region; while outward pressure for anterior portion of tooth was gained by gradually straightening the acute bend in that portion of the .030 arch wire in front of the round pin which engaged the perpendicular tube on the mesiobuccal angle of the band. The bend in the arch wire followed in a horizontal plane the angle formed by the buccal surface of the second molar as it tipped forward and to the lingual until the mesiobuccal angle of this tooth touched the distolingual angle of the second premolar. (See first models in Fig. 3.) Then the arch extended outward, then forward and downward along the lower buccal surfaces of the premolars in the form of a loop, which through gradual adjustments rotated the tooth while tipping it into upright position.

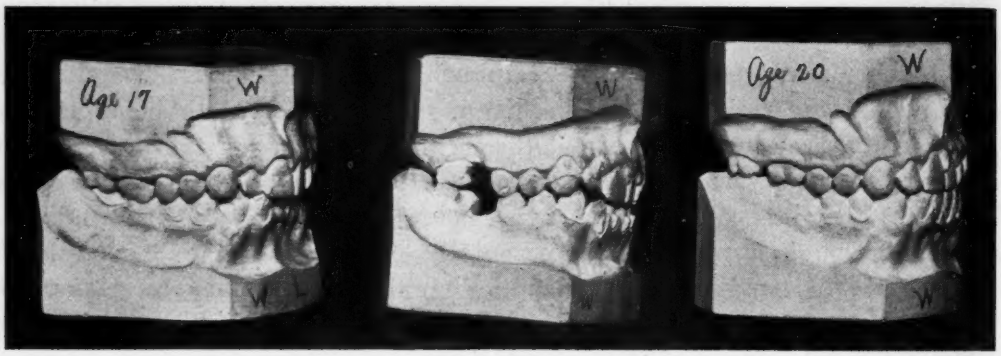


Fig. 1.

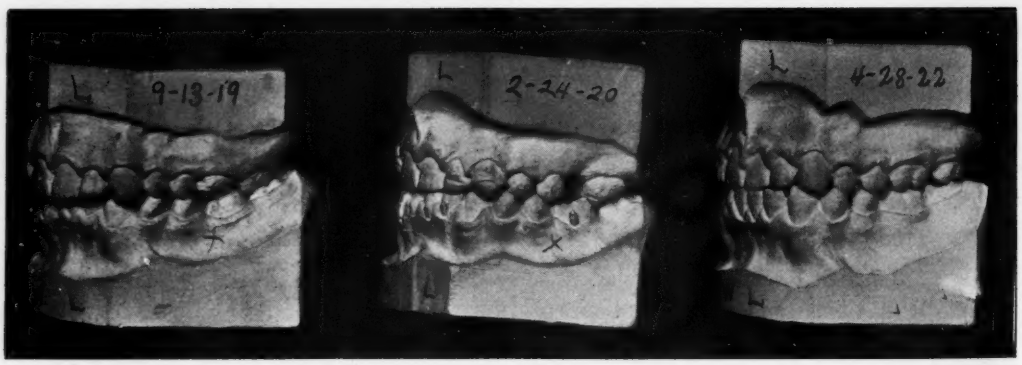


Fig. 2.

After rotating and tipping the mandibular left second molar into upright position, as shown by model made February, 1920, in Fig. 3, the perpendicular tube was changed to a horizontally-placed round tube and the arch-end changed to a smooth, round wire, which fitted the tube. Then, to overcome the lingual retrusion of the mandibular teeth upon the left side, which extended from the central incisors to the second premolar, the ribbon-arch section was bent outward in that region, accentuating the normal arch form especially in the canine region. This tooth movement was accomplished as shown in Fig. 3, by models made February, 1921. It should be noted that at this time there was further rotation to be accomplished of some of the buccal as well as anterior teeth in both arches.

The second model in Fig. 3 shows the extracted first permanent molars; unfortunately the impressions for these models were not made immediately after extraction.

The last models in Figs. 1 and 2, made April, 1922, show the result of treatment and the positions of the teeth after the third molars have all erupted. Fig. 4 shows the face before treatment. It will be noticed that the

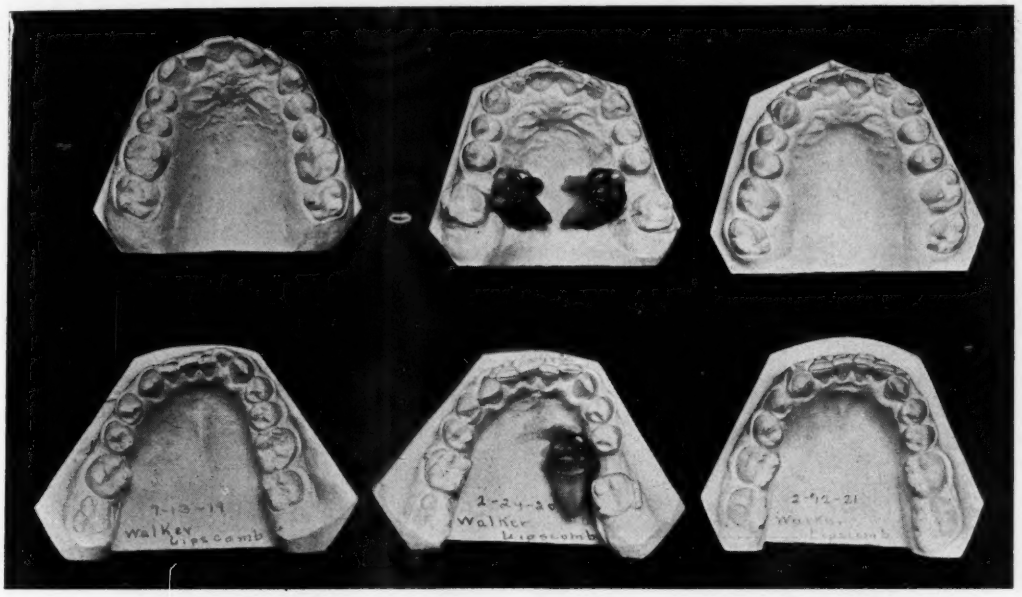

Fig. 3.

Fig. 4.

chin is lacking in development and the lower lip shows the effect of the loss of the left first permanent molar. Fig. 5 shows the face at the time the forward movement of the second and third molars was completed, and Fig. 6, a year later. It will be noticed that the lower lip and chin have improved in development and that the upper lip is not retruding; these with the models showing that the anchorage afforded through the use of the ribbon and bracket appliance on the anterior teeth was sufficient to be used in moving the posterior teeth forward.

The use of the ribbon-bracket appliance, or the pin-and-tube, is especially valuable in those extreme cases of open bite and rather advanced years as illustrated by Fig. 7. The patient was seventeen years of age, mentally and physically retarded; with filthy mouth, superficial decay covering the enamel surfaces of most of the teeth, gingivitis, open bite caused by tongue-sucking habit. The malocclusion was modified by loss of right mandibular first per-

Fig. 5.

Fig. 6.

manent molar and congenital absence of mandibular second premolars; with overdevelopment of the mandible around region of incisors, canines and first premolars; with forward drifting of right mandibular second and third molars; with lack of development of the maxillary bones and arch in the region of incisors and canines. This presented a case in which the prognosis was anything but favorable. Had it not been for the use of the pin-and-tube appliance and then later on, after the development of the ribbon-bracket ap-

pliance, the use of that appliance, the result, I believe, would not have been of great benefit to the patient.

The pin-and-tube appliance was applied to the case in August, 1915, as shown by Fig. 8, which also illustrates the tongue habit. In addition to the downward spring of the arch which was applied upon the anterior maxillary teeth, later on, intermaxillary ligatures were used from the maxillary appliances to the mandibular, in the anterior region, to augment the anchorage and stimulate development, as is shown in Fig. 9, of December, 1915.

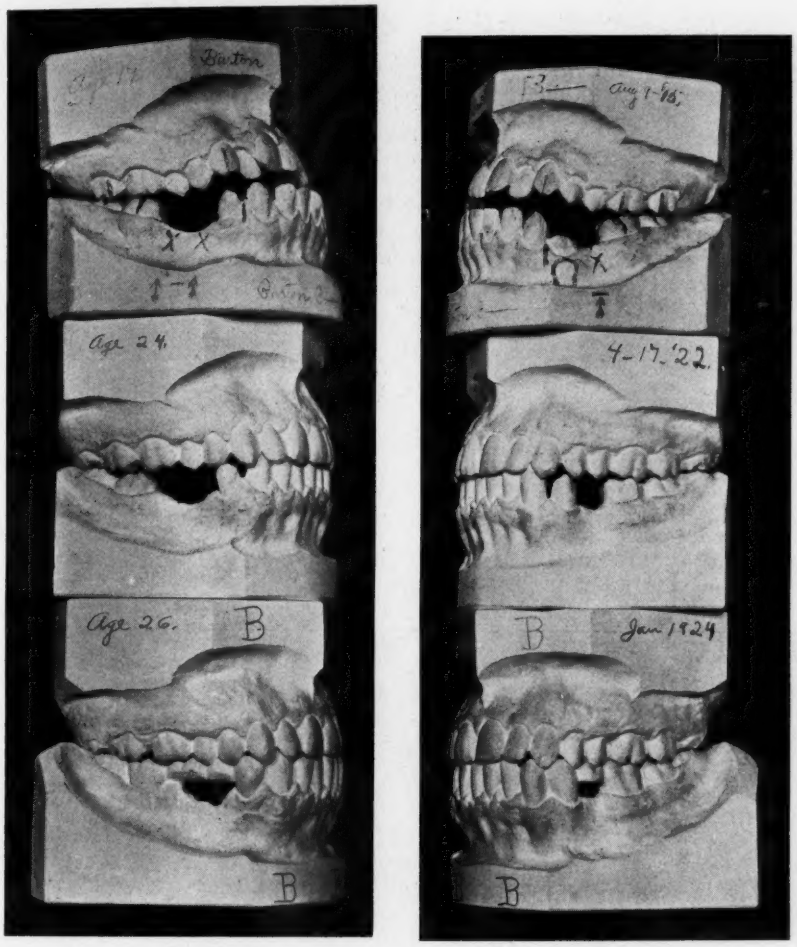


Fig. 7.

At the end of a year and a half the teeth were in occlusion and retainers applied. A temporary bridge was placed upon the right side of the mandibular arch with a movable joint between the second molar and the bridge cusps. This was to permit of individual movement of the teeth to aid in settling to place. The anterior teeth, both maxillary and mandibular, were retained through the use of a section of the ribbon-bracket appliance extending from canine to canine with spurs for the use of intermaxillary ligatures worn part time. In April, 1922, the last of the retainers was removed and the patient referred to the prosthodontist who constructed bridges to

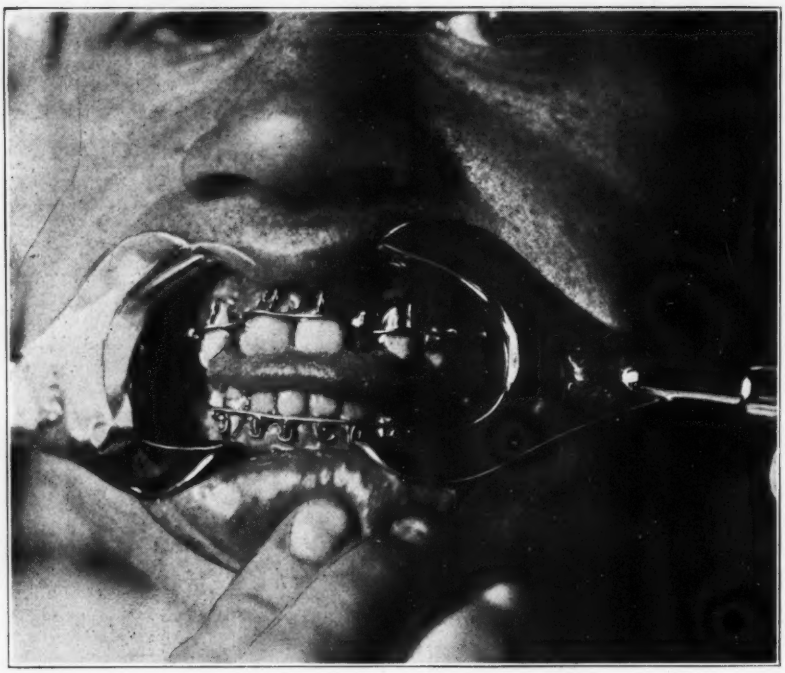

Fig. 8.

supply the missing mandibular teeth. The bridges were of the fixed type with very short dummies so as to afford maximum room for the tongue.

The models made in January, 1924, Fig. 7, show the condition of the teeth almost two years afterward. I think that these models prove that the

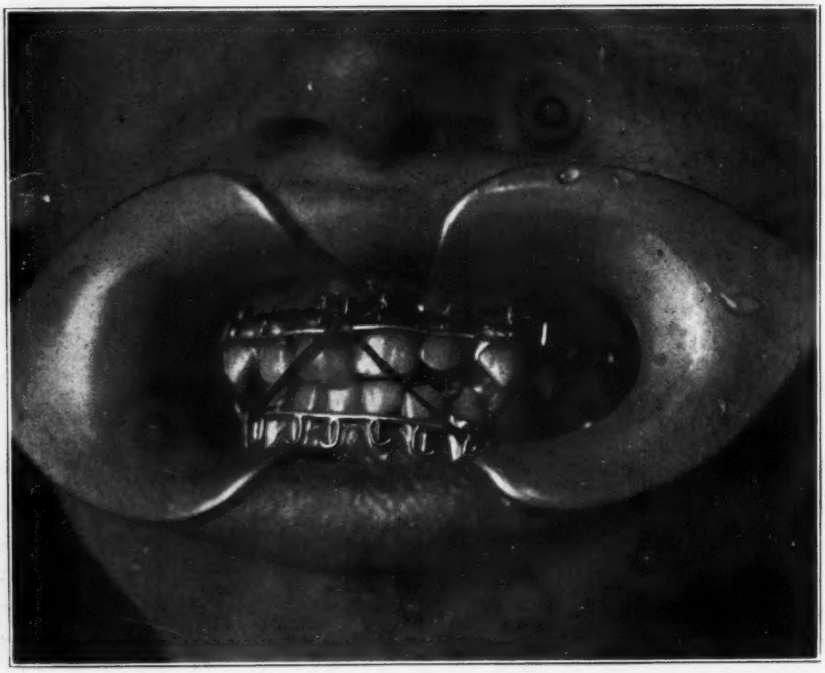

Fig. 9.

right type of appliance was used in this case and a better result secured than we had any reason to expect at the beginning of treatment.

The physical and mental condition of the patient also improved to a marked degree.

### THE SMALL DIAMETER EXPANSION ARCH ENGAGING WITH HOOKS UPON ANTERIOR BANDS

I will now suggest and describe the use of an appliance having the desirable qualities of the expansion arch and some of the desirable qualities of the ribbon and bracket appliance, but not having possibilities of moving roots of teeth possessed by the latter appliance, yet having some advantages over both the ribbon and bracket appliance and the expansion arch. It is to be used in cases where formerly the expansion arch was applied to advantage; namely, in cases where it is not desirable to change the positions of root apices by force delivered from an appliance. It has advantages over this appliance in that a smaller diameter arch may be used, and the use of liga-

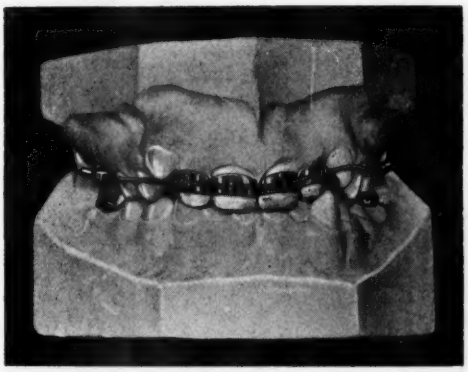

Fig. 10.

tures tied around the necks of the teeth eliminated. It also has another advantage of the ribbon and bracket appliance in that one adjustment will suffice for a long period of time. It also has the advantages in prophylaxis possessed by that appliance. In a paper given before the National Dental Association at New Orleans in 1919,[7] the writer, in speaking of the use of the ribbon and bracket appliance upon a case where the maxillary incisors were retruding or slanting lingually as in a Class II, second division (Angle) case, and where it was not desired to change the relation of the tooth root apices to the face, but only desirable to tip the crowns outward, and where the use of the ribbon arch offers great difficulties to so adjust that it will not produce unnecessary, therefore undesirable, root movement, made the following suggestion:

If treating the case today, the essayist would use the ribbon appliance upon the maxillary teeth, rounding the angles where it fits into brackets, or use an arch made of .022 Ney-Oro "E" wire, with ribbon arch ends, so as not to stimulate root movement of incisors in apical region."

It was but a step forward to attach hooks to the anterior bands shaped

something like the brackets used for the ribbon arch (Fig. 10), these hooks allowing the use of an arch wire .030 of an inch in diameter, thus affording greater strength than the .022 wire. Then the round-arch wire has advantages over the flat-ribbon arch, in that the S. S. White .030 diameter, gold platinum retaining wire of same alloy, and possessing the same amount of metal for a given length as their ribbon-arch wire of .022 x .036 dimensions, is stronger; for we know that it is a principle of mechanics that a certain amount of metal in a given length of round wire is stronger and more resilient than the same amount of metal in the flat wire form. Also, a round wire resting against a tooth surface is more easily cleaned, therefore, less hazardous to the tooth surface. Besides it is less conspicuous and makes an arch neater in appearance. I find that this appliance when used

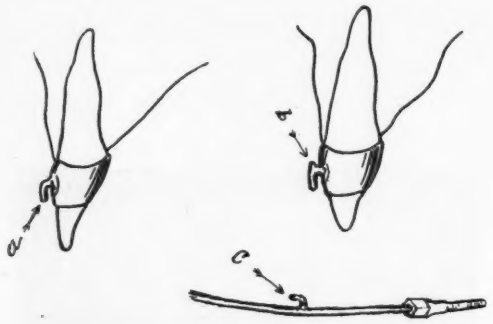

Fig. 11.

Fig. 12.

in cases where it is not necessary to change the position of the root ends of the teeth, has a decided advantage over the use of the ribbon arch.

The technic of constructing this appliance, consisting of the small diameter expansion arch engaging with hooks upon anterior bands (see Fig. 11) is as follows: plain bands are fitted to the teeth which are to be moved; a piece of .030 wire is flattened between the beaks of pliers, or ribbon arch wire material may be used, but is wide for this purpose. Wire is bent by using a small round beak plier to form a hook, Fig. 11 (*a*). The end of the hook is flattened by filing to fit against the band, a small amount of 20K or 22K solder fused to the band and then hook soldered to place; the opening pointing toward the incisal end of tooth, the space between hook and band being just sufficient to receive the .030 diameter arch wire. If the four

incisors are banded as in Fig. 10, the appliance may be locked in place from attachments on the lateral incisor band hooks. To make the lock, a little projection is soldered to the gingival side of the hook, as in Fig. 11 (*b*), by taking an .022 diameter wire and to its end fusing a very small amount of 14K solder; then soldering this wire to the hook, as indicated at (*b*) Fig. 11; then the soldered wire is trimmed to make a shallow depression for the reception of the lock which is attached to the arch, as in Fig. 11 (*c*). The lock is formed by marking the arch at the proper point; in this case, just distal to the lateral incisor band hook, then soldering a piece of .022 diameter wire to the arch in a perpendicular position extending gingivally and then bending over the hook to form an L-shaped lock, the end of which rests in the little notch at the gingival side of the hook. The size of arch wire for all-around use is that of .030 diameter. This is annealed and bent to conform to the positions of the irregular teeth and passed underneath the brackets. To the ends are soldered standard arch end sections. These fit the tubes which are placed upon the molar bands. Care must be taken that the L-shaped end of the lock does not rest heavily against the band or tooth, for should it do so, it would move the apical end of the tooth lingually. A .022 spring wire spur soldered to the arch, of about .10 of an inch in length and pressing against the band toward the incisal end of the teeth could be used to move the root labially. This is not recommended for the reason that the ribbon bracket appliance, or pin-and-tube, is more positive in its action, therefore, more efficient. The adjustment of the arch in this case for securing space for the canines is accomplished just the same as in the use of the ribbon arch, viz., through the means of tightening the nuts in front of molar band tubes until the incisors have been tipped forward sufficiently, and then the arch may be adjusted through bending, to press the canines lingually into place (Fig. 12).

### RETAINING PLATES

The retaining plate, as developed by Hawley, is another valuable appliance. I think we are all familiar with the advantage to be derived from allowing the greatest degree of freedom in the movement of each and every tooth while either guiding towards normal occlusion or afterward during the passive period of treatment. After using for the first few weeks or months a fixed retainer, the retaining plate may be employed to great advantage, with or without bands and spurs upon some of the teeth which have been rotated. In some cases there may be a supraclusion of the anterior teeth or an infraclusion of the posterior teeth. If the operator has not fully corrected this in the treatment, then a bite-plane added to the retaining plate will be found efficacious. I have found this valuable, even in some of the simpler cases, to use at the beginning of treatment.[8]

Fig. 13 shows a Class I case (Angle) where no appliance but this plate was used in treatment. The models show that there is a supraclusion of the mandibular incisors, also of the maxillary. The maxillary central incisors are rotated with the left lateral protruding. The mandibular model, Fig. 13,

shows the result obtained through the use of this appliance for a few months' time. The occlusal views are shown in Fig. 14.

Now, let us strive to become well-rounded, broad-minded orthodontists, realizing that it is only through a thorough groundwork in the fundamentals and then through observation and experience that we can become well-balanced, efficient orthodontists. Let us realize that with no single form of appliance, not even with our own "pet," is it possible for even the most skillful orthodontist to secure the best result in all cases and that in order to do the greatest amount of good for the greatest number of our patients,

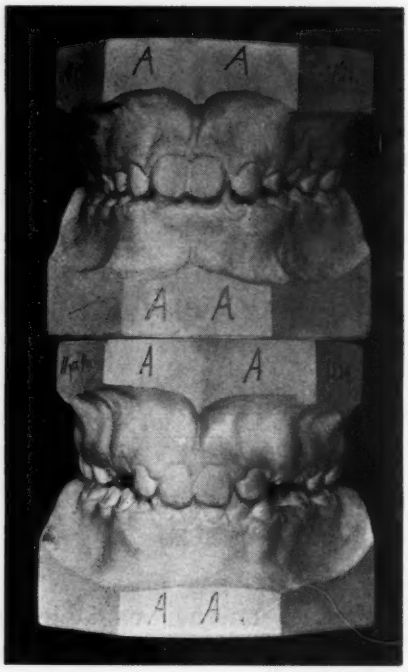


Fig. 13.

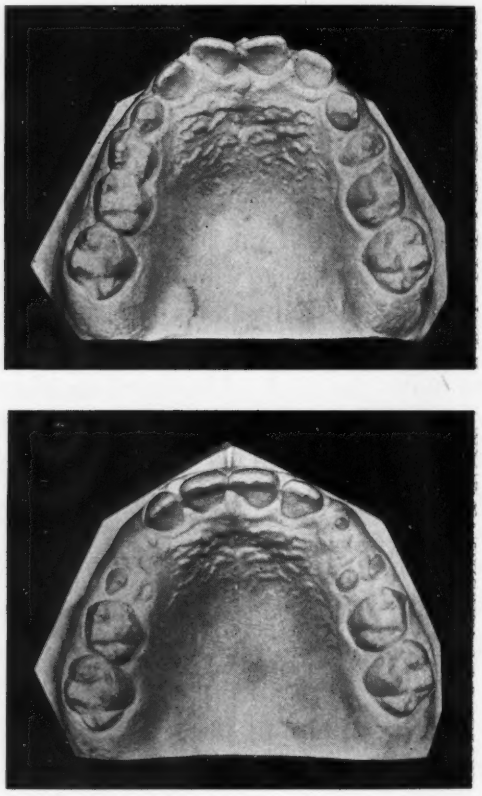

Fig. 14.

we must not only master the use of several of the more efficient forms of appliances, but that we must also devote time and thought in instructing our patients in muscle training as has been developed by Alfred Rogers.[9]

I realize that the suggestions which have been offered in this paper as to the most efficient form of appliances may not be entirely correct, but these appliances have been efficient in my hands and in the hands of my associates, and I have observed that they are efficient in the hands of a large number of orthodontists. I would state that I am open to conviction and if in error, I am ready to modify my technic to the end that we may have a standardization of methods of treatment, so that the less experienced who look to the older men in orthodontia for guidance may be able to follow the few most efficient and comparatively simple methods of treating the various forms of mal-

occlusion, and may not be misled by the alluring advertisements of the appliance manufacturer or by the inefficient, complicated modifications of appliances sometimes brought out by our less experienced orthodontists.

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## NASAL AND PHARYNGEAL INFECTIONS IN RELATION TO ORTHODONTIA*

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TWENTY-FIVE years ago no student of medicine or dentistry was required to dissect or examine the accessory sinuses, because they were thought to be of no importance. Today rhinologists and dentists know a great deal about them. During the past few years the "Flu" epidemics have increased the frequency of nasal infections. Sinusitis is as familiar to us now as adenoids, appendicitis or enteritis, therefore, I shall not burden you with the anatomy of the sinuses, but will pass on to a clinical discussion of the subject from the standpoint of the rhinologist.

The maxillary sinus, by virtue of its relation below with the roots of the second premolar and the first and second molars, which may be termed "sinusal teeth," is the cause of sinusodental affections. When an abscess exists at the roots of these teeth it is certain that the sinus does sometimes

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become infected. The process of extension is one of osteitis. The nasal origin is the most common form of infection. "Flu" infection causes most of the rhinal infection.

The adenoids present symptoms of obstruction at all ages, even infants but a few weeks old may have nasal obstructions and cannot nurse the breast. In the absence of a coryza it is reasonable to suspect adenoid obstruction.

In children from two to six years old there is more functional disturbance than at any other age. The youth and adult may have adenoids if the adenoids have failed to undergo involution with puberty or if they have been kept up by repeated colds. Any condition of obstruction with cough, impairment of hearing and hoarseness of a persistent type or persistently recurrent rather indicates the presence of adenoid vegetation.

The sinus communicates with the nose by means of an opening high up in the middle meatus. The point of the opening is poorly situated for drainage, especially so when the antrum is filled with pus. The anatomic relation of the nasofrontal duct, which drains the frontal sinuses and which empties into the middle of the fossa quite close to the orifice of the maxillary sinus, accounts for many infections of the antrum of Highmore and vice versa.

The ethmoid cells also drain into the middle meatus. This intimate relationship in the middle meatus largely explains how it is that when one sinus is involved there are others affected. The dental origin of infections of the antrum of Highmore is, in my judgment, a bit overrated in point of frequency, notwithstanding the close anatomic relation of the sinusal teeth which favors the dental origin.

Adenoids is one of the pivots of infantile pathology and a source of the majority of ailments in early life—pharyngeal, respiratory, digestive and appendicular infections, deformity of the arch, deflection of the nasal septum and imperfect development.

It is necessary to avoid exaggeration on the part of rhinologists and dentists in dealing with many of these cases. There is too much of an impression among the laity that when the adenoids are removed the whole trouble is removed for all time to come. This is a grave mistake and it has been my custom to advise all mothers to have their children's dental arch examined and corrected if needed.

Thumb-sucking is an evil that may give rise to deformity frequently overlooked. It may give rise to deformity of the face, mouth and jaw, permanent deformity of the finger or thumb, spinal curvature, tonsillar diseases and development of adenoids, mental defects, premature development of the sexual instincts, leading to masturbation, and exposure to infection. Thumb-sucking becomes an evil because of a vacuum produced, and any device placed upon the finger that will not permit of a vacuum being produced while sucking the thumb, will cure it.

This evil is more prevalent than one would think, unless one is constantly on the alert and making inquiries of the mothers, who, incidentally, will tell you sometimes the child does not suck his finger, when he really does.

I believe that thumb-sucking will thwart the correction of an arch and

keep up a nasal infection in spite of all treatment if the child is allowed to persist in the habit.

Because of the close proximity of the regions in which the rhinologists and dentists work, which makes it possible for certain local diseases to extend from the domain of one to that of the other, it is desirable that these specialists work in cooperation. For instance, I have seen an angina follow diseases of the gums or teeth and special operations on the teeth; not infrequently an angina follows inflammatory processes in the mandibular molars, especially the wisdom teeth and this form of angina always begins on the diseased side.

Resection of the apices of the roots and removal of cysts are especially prone to produce an angina, which always begins on the side operated on. This is based on a fact long ago demonstrated clinically and experimentally—that the mucous membrane of the immediate adjacent nasal orifice has a lymph-vessel connection between the intermaxillary bone and the tonsils. With reference to the enlargement of the pharyngeal tonsils, records based on a series of examinations on school children, show that in pathologic prognathism nothing can be accomplished by orthodontic measures if the hypertrophic pharyngeal tonsil is not first cured by removal.

Pharyngeal tonsils have more to do with the malformation of the jaw than do adenoids, even in cases where the hypertrophic tonsils have been removed. If the jaw is not regulated by dental treatment there will be a tendency for a reproduction of a new prolification of the pharyngeal lymphoid tissue. The inflammatory process, which extends from the diseased teeth to the nose or the maxillary sinus, is of special importance. If the pulp has been killed by caries or grinding off of the teeth, granulomata or cysts may form at the tip of the root. The granulomata enlarge at the expense of the bone, either by acute exacerbations or they may appear gradually on the mucous membrane or skin as fistulas, from the middle maxillary incisor teeth, especially as fistulas of the floor of the nose or even as septum abscesses.

Again referring to the dental origin of infections of the antrum of Highmore, granulomata of the roots of these teeth rupture toward the maxillary sinus and often cause a stubborn empyema of the antrum. The etiology is hard to discover if the teeth have been filled or crowned with care. In such cases roentgenograms are of great diagnostic value.

Cysts also may form and grow painlessly at the root or apices of pulpless teeth. They may suppurate and rupture into the mouth or maxillary sinus. The extraction of a tooth with granulomatous process at its root is, of course, justifiable both from the standpoint of the dentist and the rhinologist; but the promiscuous opening of the antrum is to be condemned because the normal mucous membrane, although the granulomas may be attached to it, is frequently capable of taking care of its own infection, provided the antrum is not irrigated and if an iodoform gauze tampon is not carried through the opening, which is too frequently done, or if a plug of rubber is not introduced to close it.

In acute osteitis of the maxillary jaw, which may be caused by careless filling of carious cavities, sometimes the pus ruptures through the nose, some-

times through the maxillary sinus. The cysts of the facial clefts are worthy of note. They are on the intermaxillary bone at the pyriform aperture, and push the mucosa forward immediately behind the entrance to the nose. They are visible and palpable under the insertion of the ala nasi and are about the size of a cherry, but they have nothing to do with the cysts as is sometimes thought. They are lined with cylindric epithelium and take their origin from displaced nasal epithelium. Fistula ruptures of these cysts toward the nose may occur. There are no direct relations between disease of the teeth and ears but there are indirect ones by way of the lymphatic pharyngeal ring and the accessory sinuses of the nose.

In this connection, I wish to mention the ear pain that is sometimes caused by diseases of the teeth. This may be produced by pulpitis or inflammation of the root periosteum and also by diseases of the gums with normal teeth. The pulp pains are transmitted by all possible trifacial tracts. Inflammation of the root periosteum and the gums lead to inflammation of the lymph glands of the lower jaw, in which the adjacent submaxillary ganglion may conduct the pain over the chorda tympani to the ear. In such cases the pain can be overcome by suitable treatment of the lymph gland inflammation.

In conclusion, I shall mention pyorrhea in relation to systemic infection. The majority of patients who have pyorrhea are subject to acidosis and indicanuria, which in turn are the causative factors in systemic infection and their eradication helps the dentist in the local treatment and the physician in dealing with the systemic conditions. The question of treatment is largely a mooted one, but I shall advance an opinion based on numerous reports of observation in such cases.

First, reduce the concentration of toxins in the blood by elimination. Second, stimulate oxidation, regulate the diet and habits and give pluroendocrines (thyroid, pituitary and gonads, in small doses). Third, overcome acidosis by hyperalkalization of the secretions; and, fourth, remineralize through administration of glycerophosphate of calcium. And last, it is to be remembered that the average pyorrhea subject is one who suffers from lymphoid insufficiency and should have iodide of lime, which is the best agent we know for such a condition. Therefore the best results come through the cooperation of the medical and dental profession.

# ADDRESS OF WELCOME TO SOUTHWESTERN SOCIETY OF ORTHODONTISTS*

By J. O. Hall, D.D.S., Waco, Texas

SELDOM, if ever, has a more pleasant privilege fallen to my lot, than that of extending to you, gentlemen, individually and collectively, a few words of welcome, to the city of Waco and the state of Texas, of which we are justly proud. Not a foolish, boastful pride, indulged in for the purpose of making words, but that basic fundamental pride of home, the natural instinct of every patriotic American citizen. This pride, true and sincere—if weighed on the same scales, would no more than balance the pride and pleasure we have in your presence among us as our guests. It is our sincere hope and desire that your meeting here will not only be filled with good and useful ideas from your program, but that each and every one of you will be saturated with the spirit of good fellowship and happiness, to the extent that you will ever remember this meeting as one of, if not the best, you ever attended. In other words, if you do not have a good time, our cup of happiness will be broken. I said a moment ago that we Waco and Texas people were proud of our city and state, and that this pride was a natural patriotic instinct of every true American citizen. I like to quote the following lines which I learned as a small boy: "Bereft of patriotism, the heart of a nation would be cold and crampled and sordid; the arts would have no enduring impulse, and commerce no invigorating soul; society would degenerate, and the mean and vicious would triumph."

Being red-blooded American citizens, and this being our homeland, naturally we point with pride to our magnificent domain, to the splendid achievements of its sons and daughters, to its matchless resources, its sunshine and flowers, its cotton and cattle, its wonderful treasure of oil and ore and minerals. It is an empire within itself, whose emblem is the five pointed star—each point of which stands for a different flag under which we have lived a life of romantic and historical interest. The biography of its heroes, reads like a tale from the "Arabian Nights." As such, all true sons, whether native or adopted, honor, love and worship our great state. To this state and to this, the central city and home of governors, we bid you a cordial welcome.

The American orthodontist, should take a very keen and laudable pride in the advancement of your special branch of dental surgery in the past few years. It has equalled, if not surpassed, other branches of general dentistry. No greater compliment could possibly be paid you than that, because dental surgery has gone forward by leaps and bounds to a high and exalted position of respect from and service to humanity within the last score of years.

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The forefathers of orthodontia did a wonderful work for mankind and build splendidly and well the foundations upon which many of you here present have reared a superstructure of real scientific attainment, that has simplified and made more positive the splendid results you are getting today from your work.

Probably no one man has added more of efficiency and comfort to the present day orthodontic methods than has Mershon, the originator of the modern lingual appliance, whom we delight to honor as one of our guests today. There are other distinguished members and visitors present who have won enviable distinction at home and abroad by simplifying and making practical present day orthodontic methods—these we also delight to honor—Ketcham, Howard, Brady, Fisher, Kelsey, Tanzy and Oliver. I am sure the Southwestern Society is keenly alive to the honor bestowed by such men upon this meeting.

An unselfish devotion to a high ideal has brought these men from far away homes and busy practices to help on the cause they love. This young, four-year-old thoroughbred, the Southwestern Society of Orthodontists, should feel proud of its achievements; a growth within four years of over 400 per cent speaks in the highest manner of the interest in your work. The attendance at the meeting is fully as large as was the attendance only a few years since of the American Society of Orthodontists, and should be very gratifying to the officers and membership. Such enthusiasm and such striving after modern knowledge is bound to bear fruit in the near future to the well being and service of your patrons. Let me extend to you in the spirit of dental good fellowship a welcome from our local fraternity: use and command us while among us, and think of us kindly when you are gone. We want you to have a bully good time. If you can beat us playing golf, teach us something of the greatest game that was ever invented for the professional man, it is the best insurance policy you ever carried. If you did not bring along your clubs, we have plenty and will gladly arrange for your comfort on the links.

Now, in conclusion, let me again tell you that we are glad to have you here. We welcome you as we love to do, with open arms and good old southern hospitality. I have tried to avoid that expression, as I believe it has no special meaning nowadays, for I have observed now for many years that, wherever I have gone, either North, South, East or West, I have received the same splendid hospitality from men of every section. And why should it not be so? The same sun shines upon us all, the same spirit of brotherly love and comradeship animates us all, and we are all brothers in common of the greatest country God has ever permitted to exist upon the face of the earth.

## RESPONSE TO ADDRESS OF WELCOME

By Dr. Harry A. Holder, Nashville, Tenn.

THERE is a saying "Let John do it." I am going to change this to "Let the secretary do it." I happen to hold the position of secretary of the Southern Society of Orthodontists and we finished our meeting in Nashville just in time to get on the train and start for your meeting here. After the strenuous work there I feel like the old negro who was a witness in a shooting case. The lawyer asked him if he heard the shot fired to which he replied, "Yes, sir." "Did you hear the bullet?" "Yes, sir, I heard it twice." "How was that when there was only one shot fired?" "Well, you see it was this way, I heard it first when it passed me and then again when I passed it." I feel as if I had been moving almost as fast as that for several days past.

Hall prefaced his remarks by saying that he was not an orthodontist. Since I have listened to LeRoy Johnson and Mershon at the Southern meeting I am willing to make the same statement. I feel like the maiden lady who, after living a number of years in single blessedness and hopeful anticipation, met one of her friends one day who remarked that she had heard that she was to be married soon and wanted to know if the rumor was correct, to which the old maid replied, "No, it is not correct but thank the Lord for the rumor." I am thankful for the rumor that I am an orthodontist but realize that there are many things connected with the moving of teeth of which I am ignorant and upon which I, as well as many others, need study and enlightenment.

We are indeed appreciative of the hospitality and fellowship expressed in Hall's address of welcome and I personally appreciate it as coming from an old classmate. I look back with much pleasure upon the days we spent together in college and I have the good fortune to live in the city with seven others of the same class. We have a luncheon club which meets frequently where we talk over college days and the other boys who shared those happy days with us, and no name is mentioned more frequently at those meetings than that of J. O. Hall. Hall has outstripped me in several things, however. First, he has made more money than I have, the top of his head has more shine to it than mine, and he has more grandchildren than I have, but with all this he is the same lovable old Hall and I know the welcome he has just extended to us is not one of words alone but comes from his heart.

I realize that your program is very full and that the late arrival of our train has delayed your opening session and I must not consume much of the valuable time, but permit me to say that it is a great pleasure for us who live in the more thickly populated sections, to come to this western country; it is an inspiration to us to come to the Empire of the West, where you raise big cattle, big-hearted men and do things in a big way. It broadens our vision, stimulates us to higher endeavors and deepens our thoughts.

I thank you again for your hearty and generous welcome and wish for you that which I know you will have, a most successful and profitable meeting.

# ORTHODONTIC NOMENCLATURE—A REPORT*

By Milo Hellman, D.D.S., New York City

THE discharge of duties by a committee of this kind is as a rule beset by many difficulties. These difficulties become obstacles when the members are so widely dispersed as are the constituents of your "Committee on Nomenclature." The desire to expedite matters prompted the chairman to take upon himself the elaboration of this report with the aim in view of submitting it to both the committee and the members of this association at this meeting. The chairman was nevertheless not unmindful of the criticism that might be elicited by such a venture. He was, however, consoled by the thought that the advantage to be gained from the deed might justify the means of accomplishing it.

In the report of the nomenclature committee made at the meeting in January, 1924,† two facts appear as the most prominently outstanding features.

1. That the faults of the definitions criticized are due to confusion; i.e., mastication is indiscriminately associated with occlusion.

2. That an attempt is being made to compromise the meaning of different terms rather than to define them more exactly.

The steps to be taken are consequently clearly indicated. Namely, it is necessary first to disassociate the concept of occlusion from that of mastication; and secondly, to formulate definitions that shall convey an exact meaning of the terms employed. But in order to proceed with care, it is necessary to be guided at first by such standard definitions as have a direct bearing on terms required for general orientation. This, then, must be made the starting point for such procedure if it is to be effective and thorough.

This part of the report is mainly concerned with definitions on *occlusion,* but definitions on occlusion involve such terms as *dentition* and *denture.* In order, therefore, to avoid as much as possible any misunderstanding, the standard definitions of these terms will be considered first.

*The New Standard Dictionary* defines these terms as follows:

**Dentition.** 1. The process or time of cutting the teeth; teething. 2. Zool. The system or arrangement of teeth peculiar to an animal. 3. The condition of having teeth.

**Denture.** The teeth of an animal collectively. 2. A block or set of teeth.

*The Standard Dental Dictionary* defines them as follows:

**Dentition.** Teething, the eruption of the teeth. 2. The classified record of a set of teeth as to arrangement, form, size and number of the genus of a species.

**Denture.** A complete set of teeth.

*Adopted at the Annual Meeting of the Eastern Association of Graduates of the Angle School of Orthodontia, May, 1924.

†Published in the International Journal of Orthodontia, Oral Surgery and Radiography, May, 1924.

*Anthony's Dental Dictionary* gives the definitions as follows:

**Dentition.** 1. The character, number and arrangement of the teeth. 2. The process of eruption of the teeth.

**Denture.** 1. The full complement of the teeth. 2. An artificial substitute for a full or partial set of teeth.

Is it not queer that **Dentition** according to these definitions means teething, the arrangement of the teeth, the teeth collectively, etc.? (See definitions.) **Denture** means an artificial set of teeth and almost all that is implied by the term *dentition* excepting the eruption of the teeth. Why would it be improper to understand by **Teething** the eruption of the teeth; by **Dental arches,** the arrangement of the teeth; by *Dentition* the natural teeth collectively either of animals or of man; by *Denture* the artificial substitutes of the teeth of man? Let it, however, be understood that these definitions do not form a part of this report. They are merely suggestions for future deliberations. They are just mentioned for the purpose of indicating the loose manner in which our terms are dealt with. For the purpose of clearness and simplicity the term *Dentition* will be used tentatively as herewith defined.

The definitions of two other terms must be mentioned before proceeding to the main discussion of this report, namely, **Mastication** and **Chew.**

In *The New Standard Dictionary,* the following definitions will be found:

**Mastication.** To crush or grind (food) for swallowing, especially with the teeth or their equivalent; chew.

**Chew.** To cut and crush, or grind, with the teeth, as in preparation for swallowing; mastication; to work with the jaws and teeth; bite repeatedly.

*The Standard Dental Dictionary* defines these terms somewhat differently.

**Mastication.** Manducation; chewing.

**Chew.** To masticate; to triturate; to comminute with the teeth.

*Anthony's Dental Dictionary* defines

**Mastication** as the act of chewing food.

**Chew.** No definition is given.

Obviously these terms convey the same idea. There being no technical difference the term *mastication* will be employed in this discussion.

The mechanical act of mastication may be analyzed on a fundamental basis. For example, viewed from a physical aspect, the act of mastication consists of a continuous repetition of two alternating strokes.

1. A positive stroke.
2. A negative stroke.

The **positive stroke** is that during which the jaws approximate each other until the mandibular teeth are brought into contact with the maxillary* teeth.

The **negative stroke** is that during which the jaws are separated and the mandibular teeth are released from contact with the maxillary* teeth.

In the process of mastication, therefore, the teeth of the maxillae* and

**Occlusion* itself in this instance, is already defined. *Functional occlusion* is a certain kind of occlusion occurring during functional activity and requires a separate definition.

those of the mandible may, at a given time, occupy one of the two positions with relation to each other. They may be either in contact or *not* in contact. It follows, then, that the main issue involved in occlusion hinges upon a concept of position. The problem, therefore, is solvable on the basis of an understanding derived by *the recognition of the relative position between the maxillary and the mandibular teeth of a dentition.*

On this basis a definition of occlusion may be formulated thus:

**Occlusion,** the relative position of the teeth of a dentition in which the mandibular teeth are in contact with the maxillary teeth. This term is applicable even when a single mandibular tooth and a single maxillary tooth are placed in such relative position to each other.

**Functional occlusion*** that form of occlusion which obtains at the end of the positive stroke of mastication, just before the negative stroke is begun.

These definitions necessitate a designation of the alternative position. That is, the relative position of the teeth when *not* in contact. Any other position than that involved in occlusion would be the negative of occlusion. The term *abocclusion* has been suggested to designate the negative of occlusion. For this term I am indebted to Geo. R. Moore and Frank S. Cartwright, orthodontia students in this year's class (1924) at the Dental Department of the University of Michigan. This term may be defined as follows:

**Abocclusion.** The relative position of the teeth of a dentition in which the mandibular teeth are *not* in contact with the maxillary teeth. In animals, this term may be applicable to the relationship of those teeth which do not come into actual contact even during mastication. Thus in certain flesh eating mammals the maxillary and mandibular premolars are never in contact. These teeth being used by the animal mainly for carrying its prey and not for chewing its food, are normally in *abocclusion.* In man, this position is manifest in its highest degree at the end of the negative stroke in mastication just before the positive stroke is begun. Also when the jaws are in a state of rest, the teeth are in *abocclusion.*

At this point a restatement of obvious facts cannot be avoided; namely, that there are two kinds of occlusion. That is, occlusion may be good or bad. *Good occlusion* is popularly spoken of as "Normal Occlusion," and *bad occlusion* as "Malocclusion." Neither of these terms has hitherto been adequately defined. In accordance with the results of the investigation reported to this society in 1921 in a paper on "Variation in Occlusion"† it is possible to define these terms more exactly, but before this is attempted certain fundamental facts must be pointed out in order to furnish a general background for a better understanding. Namely, occlusion of the teeth of man is effected by four kinds of contact relationships. First, by a relationship of surface contact; as that of the lingual surface of the maxillary incisors with the labial surface of the mandibular incisors. Second, by a relationship of cusp and fossa contact; as that of the lingual cusps of the maxillary premolars and the mesiolingual cusps of the maxillary molars with the distal pit of the occlusal

*The terms teeth of the maxillae or maxillary teeth is used to include collectively, the teeth of the maxillae and premaxillae.—Editor.

†Published in The Dental Cosmos, June, 1921.

surface of the mandibular premolars and the central fossae of the mandibular molars; or that of the buccal cusp of the mandibular premolars and distobuccal cusp of the mandibular molars with the distal pit of the occlusal surface of the maxillary premolars and the central fossae of the maxillary molars. Third, by a relationship of ridge and embrasure contact; as that of the triangular ridges of the buccal cusps of the maxillary premolars and the distobuccal cusps of the maxillary molars with the buccal embrasure between the mandibular premolars and molars; or of the triangular ridges of the lingual cusps of the mandibular premolars and of the mesiolingual cusp of the mandibular molars with the lingual embrasures between the maxillary premolars and molars. Fourth, by a relationship of ridge and groove contact; as that of the triangular ridges of the mesiobuccal cusps of the maxillary molars with the buccal groove of the mandibular molars; or the triangular ridge of the distolingual cusps of the mandibular molars with the lingual groove of the maxillary molar. The features or elements thus entering into occlusal contact relationships may be termed *factors of occlusion.* In a dentition consisting of thirty-two teeth, there are or should be 138 of these *factors of occlusion.*

The normal relationship of the factors of occlusion is based on the heritage of occlusion of the teeth in man. This heritage has been shown* to persist in its primitive form in man as in most other mammals possessing teeth. It is manifest in such characters as the accommodation of the mesiolingual cusp of the maxillary molar (protocone) into the central fossa (talonid basin) of the mandibular molar, etc. When the factors of occlusion in a dentition are all in normal relationship, the occlusion of such a dentition may be said to be 100 per cent perfect. There is, however, a range of variation in dentitions with normally related factors of occlusion from 76 per cent to 99 per cent and a standard deviation of plus or minus 5.61 per cent. The *average,* then, may be considered as the *normal,* and the *average plus or minus the standard* deviation as *the type* of occlusion insofar as the material in these investigations is concerned. Since there are no other similar investigations recorded and since this is the only scientific evidence available on the fundamental principles of occlusion, it will be used as the basis for the establishment of a concept of occlusion. With these facts in mind it is possible to formulate a definition for *normal occlusion* as follows:

**Normal Occlusion,** is that form of occlusion in which the typal number (the average plus or minus the standard deviation) of the normally related factors of occlusion are brought into effective juxtaposition.

According to this concept of the normal, two other distinctions can be made if finer lines of differences are to be drawn within the range of variability in the normal. That is, we may have an *inferior* and a *superior* normal.

**Inferior Normal Occlusion,** is that form of occlusion in which a number of normally related factors of occlusion, below the typal number but not less than the minimum, are brought into effective juxtraposition.

*"An Interpretation of Angle's Classification of Malocclusion of the Teeth," The Dental Cosmos, April, 1920.

**Superior Normal Occlusion,** is that form of occlusion in which a number of normally related factors of occlusion, above the typal number up to 100 per cent, are brought into effective juxtaposition. Then reaching beyond the borderline of the range of normal, we enter into the realm of the abnormal, i. e., *Malocclusion.*

**Malocclusion,** is that form of occlusion in which a number, less than the minimum of the normally related factors of occlusion, are brought into effective juxtaposition.

On this basis it is also possible to define more exactly the terms employed in the classification of malocclusion, but owing to certain as yet incompleted investigations pertaining to this phase of orthodontia, it is deemed advisable to defer this matter until some time later.

In submitting these definitions for your consideration, it must be emphasized that no other motive than that of a clearer understanding is the chief aim at issue. Like the knowledge in other fields of work, that pertaining to orthodontia is making gigantic strides of progress. The fundamental principles in orthodontia have hitherto been loosely dealt with. One of the most important factors for a thorough understanding of fundamental and scientific principles depends on the use of clear-cut terms. Intelligent thinking and intelligent action is dependent on it. In the words of Terman, "Intelligence is not to be gauged by the extent of one's vocabulary, but by the exactness with which concepts are defined." Dentistry and orthodontia are sadly lacking in this. The definitions which gave rise to the criticism in this report bear evidence of an increase in the dental vocabulary, but with it a confusion of concepts is imminent. The criticism was, therefore, made with the purpose of heading off such procedure, but in order that it may not be interpreted merely as destructive in character, the definitions herewith recommended are offered. There are two reasons for this. First it is hoped that these definitions will deserve the place of the confusing terms criticized and secondly, it is hoped that by the discharge of this duty a way is pointed out for a more thorough procedure in further attempts of this nature.

# FORM AND FUNCTION IN TEETH, AND A RATIONAL UNIFYING PRINCIPLE APPLIED TO INTERPRETATION*

By D. M. Shaw

THE "Maximum Shear" theory of dental mechanisms was first presented in a dental journal over ten years ago. Since then three or four papers have been published with the object of drawing attention to the leading principle therein suggested, and to provoke discussion on some of the definite interpretations that had been worked out in regard to certain specific features in the teeth of man.

Of the several theories bearing on the evolution of teeth, the Cope-Osborn tritubercular theory stands out alone in claiming to be based upon a definite *leading or unifying principle* for explaining the origin and historical sequence in the step-by-step modifications of the patterns of molar teeth. In the tritubercular theory the declared "unifying principle" in point of fact consists in the singling out of a particular shape or pattern as the prototype, and in tracing and identifying this prototype and its main elements as far as possible throughout the full range of mammalian molar types. Leaving out of discussion its soundness or possible defects, and its unquestioned fruitfulness, the so-called principle of tritubercuIy can be said to operate almost solely by seeking to demonstrate the persistence and important influence of a special pattern, and there is no recognition whatever of a persistent or predominating mode of action, or of any *mechanico-physiologic principle.* And although Osborn, in common with some other eminent workers, had long felt that some such unifying and directing principle must underlie the varied but definite and coadapted transformations in teeth, and had earnestly searched for it, in the end he falls back ineffectually on predeterminism or some unknown "law of predisposition."

The writing cut with such precision upon the complex patterns of teeth may indeed be hieroglyphics, but, even so, it was surely no random and meaningless scribbling. More probably it was a real organic language in which the principles of tooth design and mechanism were inscribed, and we might yet succeed in deciphering it if first we took pains to learn its dynamic alphabet and master the elements. Now, in the working hypothesis here put before you, it is sought to make the letters, so to speak, of this alphabet, one by one clearly identifiable as definite morphologic features, each of which is separately associated with a definite and verifiable mechanico-physiologic utility or function, and to link up and unify most of these under a leading and ever present mechanical principle. It is well to note, however, that the small incipient character—so often either passed over unnoticed or

*Transactions of the British Society for the Study of Orthodontics.

referred to as "insignificant," "undeveloped," "rudimentary," etc.—may persist in the type and remain at that stage and yet be constantly associated with a definite physiologic utility that no one is entitled to say is nonessential or of merely secondary value.

It will be best first to state a very important fact relating to the behavior of hard and tough materials—such as foodstuffs—when subjected to different kinds of stresses. Such hard and tough materials are more easily—with greater economy of effort—broken up or comminuted by *shearing* stresses than by compressive or tensile ones. In the various artificial machines for the break-up and mechanical preparation of tough foodstuffs for man or beast, shear stresses are the ones aimed at in the design and effective working of the machine. And even when there is a considerable degree of brittleness, as in dried cereals prepared for milling, the work at every stage of reduction is mainly done by shearing interaction. It was so in the case of the old stone mill. In modern milling, the "break-rolls" are finely fluted, and

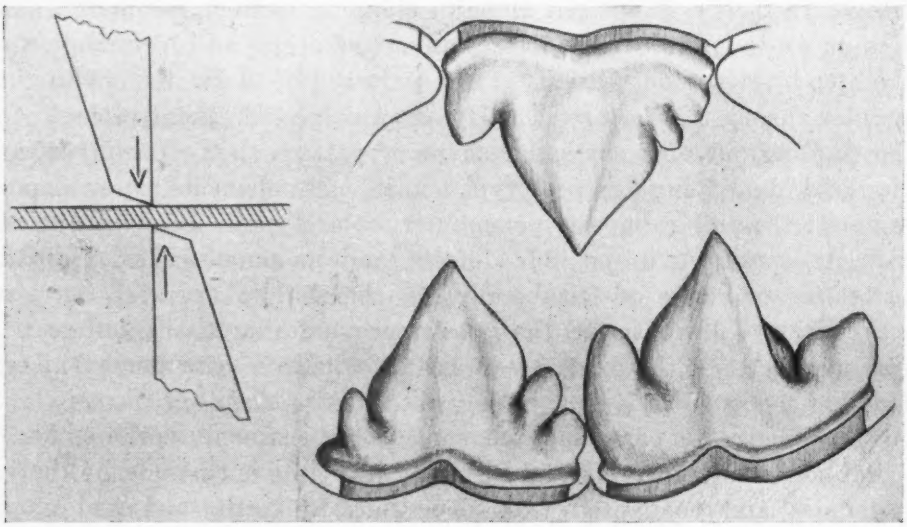


**Fig. 1-*A*.—To illustrate the correspondence between a shearing action in a scissors-like tool (on left), and that in the "sectorial" teeth of a carnivorous animal.**

by a precise and very delicate coadjustment of the steel rollers, the husks are neatly removed by the operation of what are nearly pure shearing stresses. In the later stages of reduction to fine flour, a differential velocity is given to the pair of rollers so as to subject the particles further to the operation of those uniquely effective shearing stresses. Other examples and evidence of a quantitative kind have been given in former papers, so that, until the conclusions are called in question, no more need at present be said upon that point. Something will have been gained, and one stumbling-block to the understanding of my main hypothesis perhaps removed, if now what is really and properly connoted by the term "*shear*" is the better apprehended.

Figs. 1-*A*, 1-*B*, and 1-*C* give the physics textbook illustrations of a *shear* force acting chiefly across one plane, as in scissors; and in the glued

prism of India rubber, acting across many successive planes and producing merely a distortion or change of shape. Alongside is shown, as corresponding to these two extreme or very different examples of shearing action, the teeth (sectorial) of a carnivorous animal, the multi-bladed cheek teeth of a horse, and the nearly flat molars of an elephant.

Seeing then that some time in the past man had discovered the special utility of shearing action and had brought it into his service in an increasing variety of contrivances, we need not be overmuch surprised to find that Nature, with her immense output under the pressure of a ceaseless competi-

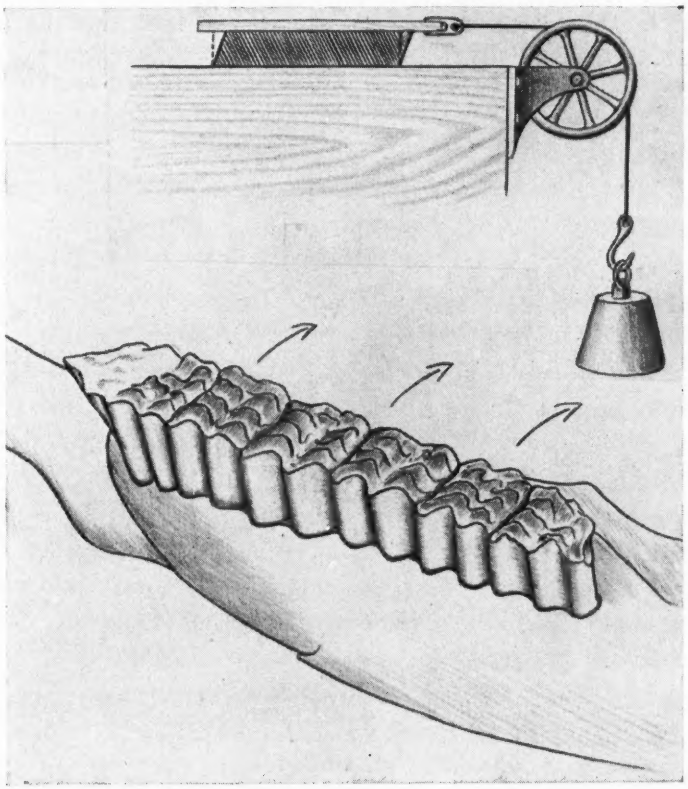


Fig. 1-*B*.—Showing (on top) a textbook example of a "simple shear force" acting across many planes, but producing only distortion of the material (India rubber); also the potential shearing across the multi-bladed cheek teeth of a horse.

tion, had also "discovered" that same principle and special utility of shear action. And Nature has indeed applied it, and thoroughly tried it out in those very organs, namely, the teeth, wherein the elaboration and refinement of tool-like devices is so variously and overtly displayed, and where unquestionably the attainment of a purely mechanical efficiency is the all in all. Almost throughout the vast range of mammalian dentitions, as well as in certain other types, form and mechanism would, I suggest, seem to be very largely determined by this paramount requirement for operating mainly by shear stresses. The relatively very few types that stand as easily recognized exceptions are in themselves significant and, as it were, negatively instructive in showing that when teeth are so shaped and related that

they cannot and do not operate by shear stresses, no fine reduction or comminution of hard and tough food takes place; or, if comminution does take place in the mouth, these teeth play practically no part in the process.

Turning at this point to meet an imagined interjection, the impediment or doubt may be expressed somewhat as follows: Accepting all that can be said as to the superior effectiveness of shearng action, and granting also that its dominating character and functional value in mammalian dentitions had not previously been stressed or even pointed out—why and how should this obscure hypothesis of maximum shear give promise of being a useful instrument for investigating the mode of evolution and the physiologic mechanism of teeth? Broadly, the answer is: First, that as artificial and natural machines for the break-up of moderately hard and tough materials

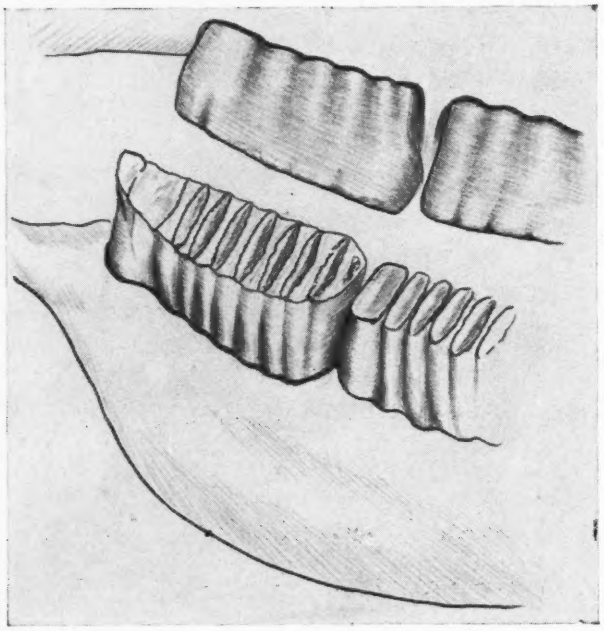


Fig. 1-*C*.—Opposing molars of an elephant, nearly flat; where, with hard bulky food material, there may be more of true crushing and splitting than of shearing action; but with thin material (leaves) shearing forces will predominate.

operate mainly by shear stresses, it is not irrational to suggest that in any animal dentition, or any given linear series of dentitions, the plan or design of the machine, its unit forms and mechanisms, and the phylogenetic changes therein, must each and all have been very largely directed, guided and controlled by this constant and paramount requirement of functioning mainly by shear stresses. Second, in a machine definitely so designed and so functioning, the specific or established forms, mechanisms, etc. (however widely varied and diversified they might be—and as indeed we know them actually to be) would not vary or dispose themselves in endlessly indefinite directions or in random formations, but rather be picked out and assembled and correlated in strict and definite response to the needs and special working principles of just that particular type of machine mentioned

—i.e., one dominated by interactions mainly of shear. What I am trying to bring out is, that if the dental machine were, in its principle of operating, of some other distinctive type, say one acting mainly by compression, tension, concussion, or what you will, the various working parts, the habitual direction of thrust, and the details of form and mechanism would then present characters which, while doubtless adapted for efficiency in that supposed type, would yet in recognizable ways be quite different to the characters required and met with in dentitions of the maximum shear type. Each such type might conceivably have its own leading mechanical principle holding sway in response to the dominating kind of stresses and strains that were functionally called for. But here we are concerned only with mammalian dentitions, where throughout the innumerable modifications of design, the grip on the fundamental shear principle is hardly ever once slackened. While no doubt the Cope-Osborn triad comes out clearly enough as a *leit motif* in many of the more primitive and simple dental compositions, the "shear" idea even in these is often the significant tone, and it certainly becomes the leading theme elaborated and insistent in nearly all the complex and more refined productions.

The foregoing gives in short outline some idea of what I might call the general theory or principle of maximum shear as applying to tooth forms and mechanisms. Its step-by-step application to the interpretation of mammalian teeth can hardly be illustrated in this short paper, nor do I for a moment pretend to possess the knowledge and competence required for handling the vast subject. But in any case a fruitful application of the general theory must be yet for a long time delayed, because exact information is almost completely lacking in regard to what I consider to be, in any rational theory for the interpretation of dental mechanisms, the two most radical factors. First, *the physical character of the food;* second, *the degree of reduction or comminution effected* before the food leaves the mouth.

Passing away then from the general theory, we turn perhaps more hopefully to the special theory as applied to the teeth of man. Here we are in a much better position for studying the two prime factors of character of food and degree of its reduction. And after all, to quote from Dr. F. A. Bather's masterly address, "Fossils and Life" (*British Association Report,* 1920): "The analysis of adaptations in those cases where the stimulus can be recognized and correlated with its reaction affords sure ground for inferences concerning similar forms of whose life-conditions we are ignorant." It was in that spirit and by that rational method that I, in the paper as first presented, invited your attention to a unit-by-unit observation of what takes place in the human mouth as each pair or group is erupted and brought into functional use. Summarizing now those results, and beginning with the deciduous dentition, the following are among the points that seem to emerge:

1. (*a*) When the deciduous incisors are erupted and in occlusion, the superior group are in most cases observed to be vertically and externally overlapping the inferior group (Fig. 2).

(*b*) These eight incisors—as also of course the very first arriving pair—

have found their way unerringly to a position and relationship which may be regarded as that of normal occlusion. Imagined crude mechanical guides or oral "vergers" play a very subordinate part in the "seating" arrangement, if any at all: the directive *growth force* is sufficient, normally. There is, of course, here no need to refer to the part that may be played by Keith's executive hormones from this or that important ductless centre, or to cogitate

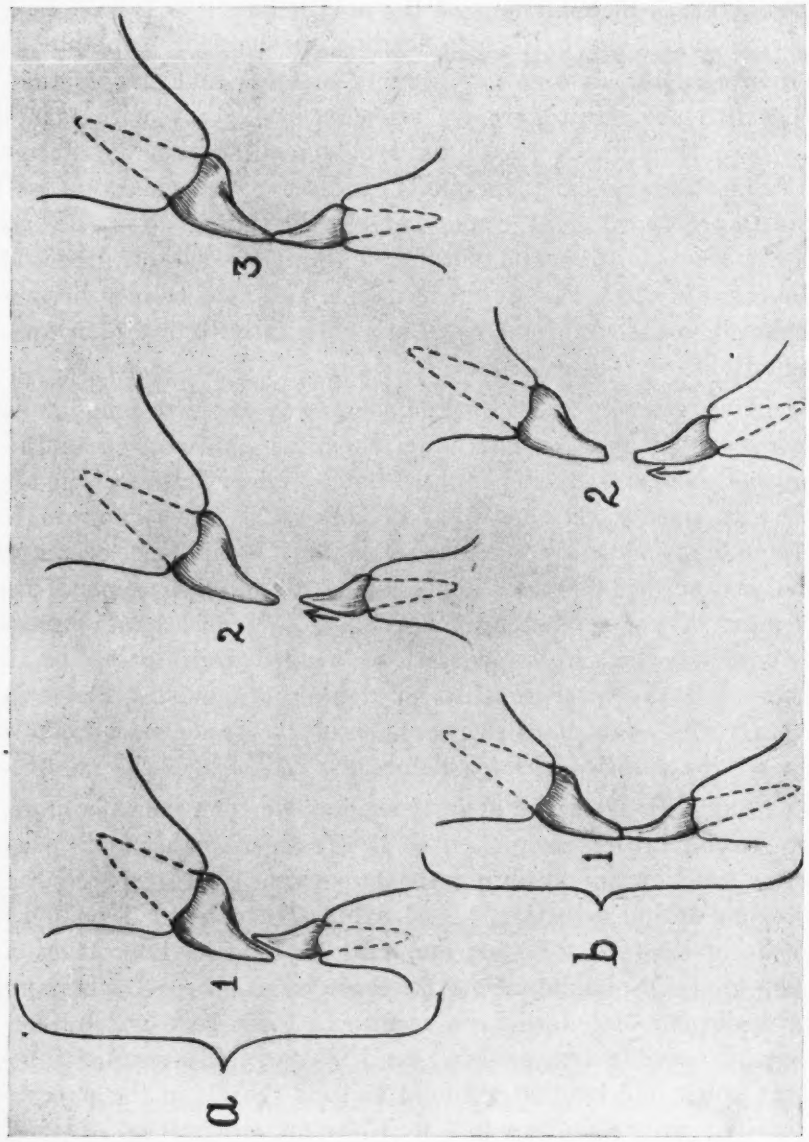



Fig. 2.—Diagram showing in *a1* the normal occlusion of man's incisors, from which the positions *a2* and *a3*—"edge-to-edge"—can readily be taken up. The "primitive" edge-to-edge occlusion in *b* is less effective in shearing and in conservation of the hard dental tissues.

whether indeed the full plan and details may be docketed in some more remote and unapproachable head office situated inside or outside our marvelous clayey habitation.

(*c*) The overlapping occlusion is definitely a provision for operating by shear stresses. The efficient "shear" principle is thus introduced and actively established in the dental machine at the very beginning. There is there-

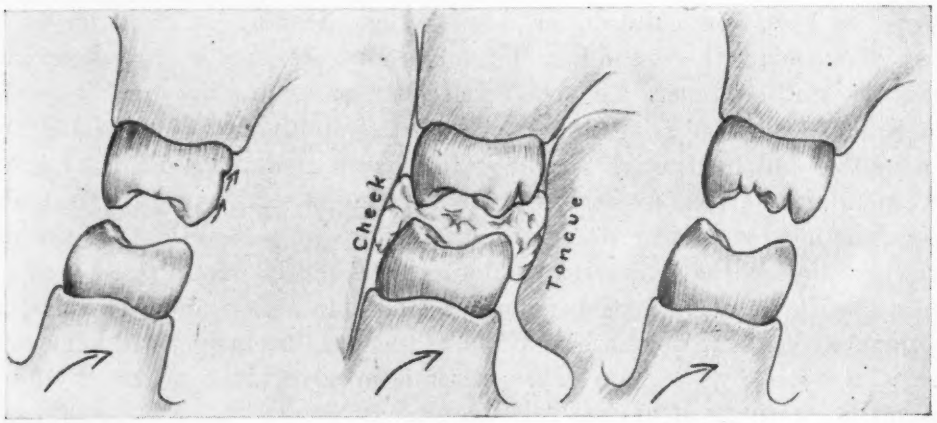
fore good ground for inferring that, even at this early stage, the protrusive and lateral motions of the mandible, and the related co-ordinations of joint and muscle action, are called into play and their character largely determined in response to the requirements and the special effectiveness of shear stresses. Such movements would have practically no meaning or value in a machine of the nonlapping, edge-to-edge, or the nonshearing type. And in the coordinations spoken of, a fine degree of precision in the direction of thrust has to be provided, and is often called for.

(*d*) These normally placed incisors can also readily undertake, in addition to their special function by close shearing, those gnawing, biting and nipping functions to which the edge-to-edge or nonlapping dentions are perforce and entirely restricted. Edge-to-edge may or may not have been the normal occlusion in some primitive human races: it certainly is less efficient in function and in conservation of the hard dental tissues than the arrangement found today and in recent and many early types (Fig. 2).

(*e*) Probably tongue or lip biting sometimes happens at this stage; but difficult to verify in children so very young. It may occasionally be the cause of some of those sudden and unaccountable bursts of crying which cloud the smiling blue. The child normally must practise and learn how to masticate much the same as he must practise and learn how to walk. And, as penalties and instructive warnings for errors made, the painful mis-bites correspond to the falls and mishaps in learning to walk upright. But while early functional errors or defects in the organs of locomotion for the most part right themselves or are remediable, a persistently wrong method of masticating, with its related perversions of muscular action and of mental and emotional attitude, to say nothing of consequent malocclusion, will very rarely become rectified by the mere lapse of time, or give place to the rhythmical and healthy activity of normal mastication. In regard to the important question of when a young child may first begin to acquire, or rather have forced upon him, the vicious habit of swallowing unmasticated lumps, we would fain believe that the reflex actions which guard the throat-way have not at this early stage been much blunted in sensitivity, nor just yet been pushed to inhibition by persistent ignorance and bad example in the matter of food and feeding. We do know that when a healthy child is allowed to exercise his first group of finely fluted chisels upon a piece of crusty bread, his untaught procedure then lacks nothing in deft and attentive skill, or in patience, or in placid enjoyment.

2. (*a*) With the increasing intake of solid food, double or multi-bladed teeth are next required in order that fine comminution of the increased quantities may be carried out more freely and efficiently than would be practicable with the single-bladed group. According to my hypothesis, a fundamental requirement at this transition stage is some such modification, or additional elements in the shape of the next arriving tooth, as will be definitely adapted to holding—and helping the tongue to hold—the smaller food fragments in proper position for their finer reduction by the obliquely-directed shearing stroke. And (as I showed in earlier papers) whether a lingual cusp be small

or large, its prime utility and function is that of holding the smaller food fragments in correct position for further reduction, an absolutely essential requirement in almost every kind of machine for severing or subdividing material. The dentist hardly needs reminding that as one endeavors (with shears or nippers or any other tool) to subdivide pieces of metal or what-not into progressively smaller and smaller fragments, the always essential matter of holding each piece in proper position becomes progressively more and more difficult. That is precisely the kind of difficulty and need a carnivorous animal would have if we imagine it vainly attempting to subdivide its tough flesh food into very small pieces by the action of its trenchant shearing blades. But the accessory dental element or device required for food-holding is phylogenically not the first but the second definite step or acquirement in that three-step functional ladder, by which alone an incipient modification can be conceived to advance from its food-deflecting and gum-shielding office, and at length climb to full cusp size. The highly variable "tubercle




Stage 1. Stage 2. Stage 3.

Fig. 3.—Three functional stages in suggested evolution of "fifth cusp."

of Carabelli" was available in the living mouth for tracing the relation between form and function at each of the three definite steps or distinctive kinds of utility (Fig. 3).

(*b*) In the study of the uniquely-shaped deciduous first molar, described in detail in the *Dental Record,* July, 1914, the interpretations arrived at were, briefly: These molars are the first group of edged-and-pointed teeth to come into use. The bluntness (as compared with all other postcanine teeth) of the edges, the obtuseness of the angle formed at the cusp point by the confluence of its cutting edges, and the peculiar way in which the mandibular cusps are drawn together, are conditions all effectively adapted to protect the busy young tongue and cheek, and to reduce the undoubted risk of tongue and cheek biting (Fig. 4).

(*c*) That marked but unexplained characteristic of all deciduous teeth, the bulbous base which overhangs the constricted neck, can with all reasonable surety be interpreted as definitely adapted to shield the soft investing tissues from injury during mastication. The "chip off-throw" or tangential

deflection of hard food fragments is in its angular direction the same for both milk and permanent teeth; so that, in point of fact, the shorter crown-wall of the milk tooth must have a relatively greater degree of vertical convexity in order to ensure the same or an equally-good factor of safety, in chip deflection (Fig. 5; also *Dental Record,* August, 1909).

(*d*) The remarkable "bucco-gingival ridge," found on all deciduous first molars, is a local accentuation of the chip-deflecting feature, and is uniquely adapted to protect that delicate buccal frenum which, at the period of eruption and for a short time after, is inserted close to the enamel ridge and sometimes springs from the very margin of the gum almost in contact with the base of the sheltering ridge.

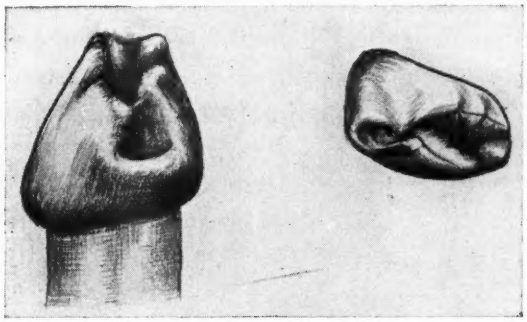


Fig. 4-*A*.—First deciduous mandibular molar, showing protective convergence of cusp surfaces and points.

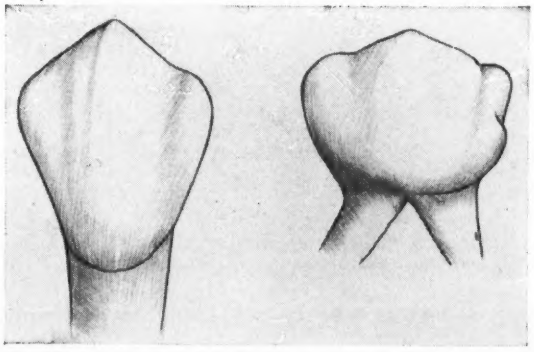


Fig. 4-*B*.—Maxillary premolar and first deciduous molar; compared to show difference in angle of cusp point.

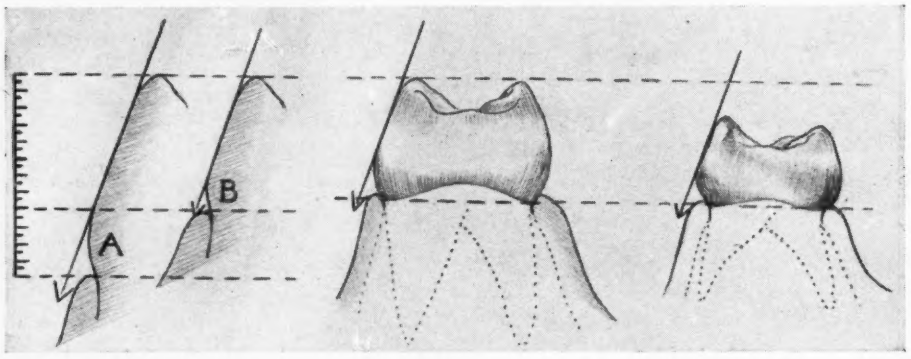
3. (*a*) The teeth next set up in the machine, the deciduous second molars, are in the main features of crown-form identically the same as the corresponding first permanent molar in at least 80 to 90 per cent of mouths wherein both units are *in situ* for comparison.

(*b*) But, in addition to being smaller and vertically shorter, this deciduous tooth has the sharper edges, and its occlusal surface is more delicately and effectively sculptured and fluted out to produce those edges. The unworn deciduous second molar is—so to say—finer and more thorough in mechanical design and finish. The second milk molar of our modern day is in many respects the last word in perfection of efficient design in the evolution of molariform teeth in man. But the main deep grooves or fissures,

which in permanent teeth help to conserve some of the cusp edges from blunting attrition by their opponents, are almost absent and are hardly required in the more transient deciduous ones.

(*c*) Relatively to vertical length of crown, the depth or extent of shearing overlap of these deciduous molars is proportionately greater than it is in permanent molars.

Leaving now our close watch on the unit-by-unit assembling of what is truly the child's working model of the dental machine, we can suppose that with the arrival of the canines there has been set up a masticating apparatus that is complete and fit for efficient service during the next four years.* During those four years, if ever at all, have been acquired, and perfected by exercise, those complex coordinations of muscle effort that govern the normal free and rhythmical movements of mandible, cheek and tongue. Those varied but definite movements being acquired and well established in the musculature, what could be more favorable to a continuance of smooth and




Gum menaced in B, where neck of (imaginary) *shorter* crown is unmodified.

*Permanent.*

*Deciduous.*—Gum sufficiently sheltered by bulbous base.

Fig. 5.—Permanent and deciduous molars, showing (on right) how shorter wall of deciduous tooth is modified at neck to secure the same "factor of safety" in chip deflection.

efficient working than that the next arriving group of molar teeth should be of identically similar pattern? And so we find it to be, the permanent first upper molar even carrying the mimicry so far as almost invariably to bear a fifth cusp whenever that feature is present on the deciduous molar. I have handled several deciduous second upper molars each bearing a fifth cusp which, in size and details of shape, is exactly like each and every one of the other four cusps, and in it, as in the others, the grooves which flute out and sharpen the cutting edge encircle a well-formed rounded "umbicle" or tongue shield. This very exact duplication of crown-shape is doubtless in response to exactly identical environments, or to Lankester's "common action of evoking causes," and in this striking instance it is within our power to examine

*The quiescent interval between the eruption of one group and that of the next succeeding group is usually explained by the alleged need of a rest, or recuperative period. In the case of the temporary teeth, at any rate, an equally good or additional explanation is the clear advantage conferred by allowing the child time to practice and acquire proficiency in the use of one new group before the next arrives.

carefully such important factors as physical character of food and degree of its reduction, the habitual character of jaw movement and direction of thrust, and also the functional movements and reacting influences of tongue, cheek, etc., as in part determining certain features in the form of the crown.

As to the premolars, I elsewhere described in full detail their forms and true occlusal relationship. And in the *Journal of Anatomy* paper, the important food-posing and food-holding function was shown to be demonstrated in a specially convincing way by the lingual cusp of *upper first premolars,* because the morsel-or work-holding requirement is there the essential one during the upward and inward shearing thrust of the single-bladed lower first premolar (Fig. 6).

At the age of about ten or eleven years there is what we might call a moderately full mouth of permanent teeth. The apparatus functions per-

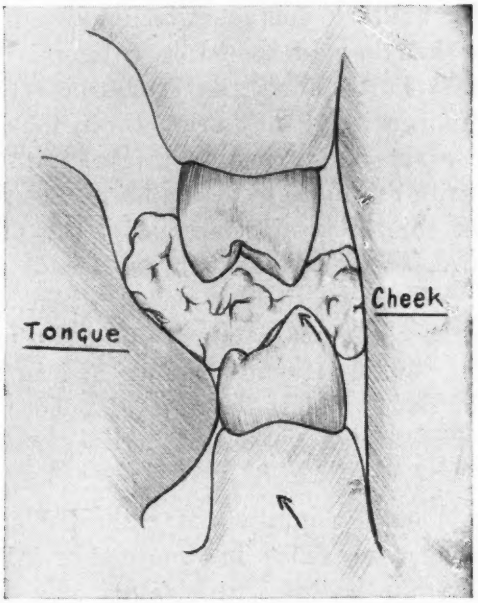



Fig. 6.—Showing prime function of lingual cusp of first maxillary premolar,—that of *holding* the "work" (food morsel) in proper position for the shearing thrust of the mandibular first premolar.

fectly, notwithstanding that there has not yet been developed on the general morsel plane that upward sagittal curve which has for so long been miscalled the "compensating curve," in the mistaken and unfounded belief that its special function was, during incisive or protrusive movements, to provide balancing and strain-relieving contacts. The true interpretation of the sagittal curve at second and third molars is to be found simply in that rigid economy of space which Nature observes, and which is always associated with economy of effort and of material.

I venture to suggest that this Society is well fitted to deal with a current and long held misconception in regard to the real conditions that exist in what I call the relationship of *non-occlusal* contact, this term serving to distinguish the condition quite clearly from the only other kind of intermaxil-

lary contact—*occlusal* contact. When from a position of normal occlusion the lower teeth are moved laterally in sliding contact with the upper teeth, the more extensive the total area of surfaces in continuous and simultaneous contact, the more nearly does the condition then approach what is supposed to be the normal or ideally normal one. A skull with the full complement of sound, well worn teeth is handled admiringly, and then, when the mandible is deflected laterally with all the convenient freedom allowed by the empty glenoid cavities, and the cheek teeth are made to slide in continuous and fine fitting contact, the remark is often evoked: "How beautiful!" Certainly would the picture be a beautiful one if the prime function of teeth were but to grind and deface one another, and if the efficient comminution of food were a merely secondary function. I have a number of plaster casts of sound dentitions that were as nearly normal as could be found. Each pair of casts has, by a careful technic, been immovably mounted in the exact relationship of intermaxillary contact which existed in the living mouth when the lower jaw had been deflected in a lateral excursion. These and other intraoral studies but confirm the conclusions I had reached a good many years ago. Put concisely, they are: First, the area of opposed tooth surfaces in actual contact at any instant attains its maximum amount only when in the one definite relationship of occlusion. Second, in moving in any direction away from this occlusal relationship, the area of possible simultaneous contact is progressively decreased, and tends towards the minimum amount. Third, in unworn or little worn dentitions the total area of the maximum intermaxillary contact attained in occlusion does not normally exceed three or four square mm. in amount, and in most of the laterally deflected positions of the mandible the area of nonocclusal contact drops to a minimum which is restricted to contact between a single pair of opposed canines.

The supposed kinematic condition of extensive contact areas does not normally exist, and but rarely exists in abnormal or in much worn dentitions, where undoubtedly we are dealing with a faulty or a deteriorated apparatus. It should be quite obvious that any masticating work done between two opposed surfaces or edges must take place and be quite finished before those surfaces can come into contact with one another. In the working of any such machine, natural or man-made, the contact and attrition of the tool surfaces is not in itself an end or a functional aim, but is merely one of the unavoidable results of the constructive limitations and restraints imposed by mechanical or physical laws. And if anyone seeks for beauty in design, or a real instead of a fictitious cause for admiration, he will find it, not in Nature's supposed attempt to multiply contact areas, but in the wonderfully simple and effective arrangements by which useless contacts are avoided or kept down towards a minimum. The oblique direction of the condyle path, by which the moving mandible is compelled to come *downward* as well as forward, has normally the one essential function of throwing out of "mesh" and out of potential contact all the teeth except those that at any given instant are to act as the tools in that particular masticating thrust.

It is so in a protrusive movement, when both condyles come downward to disengage the nonfunctioning cheek teeth from useless contact, and in order that the anterior teeth can operate freely in an incisive or a shearing thrust. So it is also in a lateral movement, when one condyle comes downward to throw the teeth on that nonfunctioning side out of contact and needless attrition. These remarkable "fine-adjustments" in the physiologic mechanism can be observed to be still acting for the conservation of effort and of tooth tissue even when, in a sound denture, the teeth have become much worn down. On the other hand, in some not uncommon abnormal conditions the vertical anterior overlap may be so excessive as altogether to prevent the cheek teeth from coming into effective shearing alignment; but that is another story, and outside the present discussion.

Taking but one last glance at the completed normal denture of thirty-two teeth, it is well to observe that the anisognathism, or effective shearing "overhang," is just as definite at each and every one of the check teeth as it is at the anterior teeth.

I conclude by quoting the last paragraph from my paper to the Sixth International Dental Congress. "I have called that line (or curved surface) in which the external blades of all the maxillary teeth lie, '*the line of maximum shear.*' It is along that fixed line on the upper teeth that the external blades of the movable lower arm seek to deliver at any point a thrust of maximum shearing value. The highest masticating efficiency—and to that extent the good health—of the dental apparatus depends upon preservation of the functional integrity of that curved line. It is common knowledge that malocclusion or any breach in its integrity tends to encourage conditions that may become destructive, and that in some cases—and in different degrees by different people—are considered to be esthetically objectionable. Yet it cannot be stated as a fact that the malposition of one or more teeth will inevitably or of necessity be followed by any or a single one of these inimical conditions. The *one thing* that does inevitably accompany any displacement of a tooth or teeth from the normal position is—that the shearing efficiency is in some degree depreciated, not always or necessarily at the displaced tooth, but unfailingly at *some* locus along the damage 'line of shear.'"

DISCUSSION

*The President* said the members had listened with interest to the paper which was somewhat difficult to follow completely, but the main principle, the question of shear, was one which was emphasized to a degree which would make an impression upon the members. It gave matter for thought even though many might believe that they had already thought about it. Mr. Shaw had certainly raised several points which would lead to considerable thinking. As those who had worked at the Royal Dental Hospital knew, Mr. Shaw was very keen indeed upon theoretical considerations, not necessarily those connected with prosthetic work alone. He had written a large number of papers and had put in a great deal of labor upon the various subjects. Probably the paper that evening was on a subject which was more dear to him than any other, and should be a subject of particular interest to Dr. Sim Wallace.

*Dr. Sim Wallace* said he was sorry he had no comments to make except to say that he had nothing but sheer admiration for the whole paper.

*Mr. Pitts* said that, as far as he understood it, Mr. Shaw's idea was that there was a definite correlation between the shape of the teeth and the function that had been assigned to them, and that the two had apparently evolved *pari passu*, so that, in theory at any rate, it ought to be possible to say that in any stage of the evolution of mammalian teeth a certain function attached to the particular form at any given time. That was getting into very deep waters in connection with evolution. If it was true it must be true for a great many other parts of the body as well. Although there was an undoubted relation between form and function it did not always follow that the two evolved side by side. Sometimes it might be found that an entirely different function might become grafted on to some particular organ when it had appeared to outlive its usefulness. The pineal gland represented the rudiments of the third eye, but in man it was now one of the ductless glands with a specific function. There was also the suggestion that the neurenteric canal represented the primitive alimentary canal of invertebrates. In man function and form did not seem to have evolved side by side in that case, and it might be possible to find a good many other examples in anatomy. It seemed to him that a good deal of the proof of Mr. Shaw's paper must be obtained by a very close study of comparative anatomy. He certainly agreed with Mr. Shaw that the physiology of mastication had not been studied with sufficient care. Dr. Sim Wallace had added a great deal of knowledge on that point and shown how complicated it was. In a paper he himself had read some time ago, arguing from the shapes of the contact points of the deciduous teeth, he tried to imagine what the component movements of mastication were. He had always felt that probably in man the mastication or the various components of mastication developed very much at different periods of life. They might develop very considerably indifferent individuals. There might be perhaps several different forms all of which could be regarded as normal. Undoubtedly abnormal forms of mastication might rise quite early in life from premature loss of teeth. Mr. Shaw had made the point that the shear type of movement seemed to be very early evolved. He had been very much interested to hear what Mr. Shaw had to say on the tubercle of Carabelli. Another writer had given an entirely different explanation, not based on function, but rather on form, and thought it represented a third characteristic of dentition, that mammalian dentition represented the fusion of two different elements and the tubercle of Carabelli represented the third. If Mr. Shaw's view was correct, that it had evolved in response to a definite function, it would be found to be very infrequent in primitive man and still more infrequent in the anthropoid apes, in which the masticatory function on the whole was much more efficient than in modern man, in whom the tubercle of Carabelli was very common.

*Mr. George Northcroft* said it seemed to be a little unfortunate that yet another term should be invented for a process supplanting words which were already in use. For instance, he could not see why the grinding action of the grindstone should be described as a shear; it might be that it helped to convey to some minds with greater accuracy the action which took place, but the term grinding had always been used and he did not see why the term shear should be introduced. He had a very fair picture of what Mr. Shaw meant by maximum shear of the teeth, but surely maximum shear was obtained in the carnivora and certainly not in man, who had a modified shearing action and not the perfected shearing action obtained in the seccateur action clearly shown on the first diagram. Mr. Shaw frankly admitted the possibility of man having had an edge to edge bite, which Prof. Keith was quite sure was so; it, therefore, seemed rather unwise to point out the beauty of the adaptation of the human dentition to the efficient maximum shear principle, when it must have been absent for about a million years. Our ancestors surely had as difficult feats of mastication as we perform today. They did not seem to suffer in the efficiency of their masticating apparatus because of the more marked absence of maximum shear.

*Mr. Badcock* admired immensely the patient enthusiasm with which Mr. Shaw had pursued his subject; perhaps it had a greater bearing on prosthetics than on orthodontics. Dental surgeons had appreciated what happened but not with the accuracy and minuteness

which Mr. Shaw had pointed out the underlying features of the way in which human masticatory mechanism acted.

*Mr. Harold Chapman* said that perhaps the point of most orthodontic interest in the paper was that related to occlusion and shear combined. His own conception of occlusion was that shear operated by means of the buccal and lingual cusps, but Mr. Shaw had made it clear that shear operated by means of the buccal cusps more than the lingual cusps, which were also food-holding devices. Mr. Shaw had previously pointed out that the lingual cusps of the premolars did not occlude between the cusps of an upper and lower tooth, which perhaps would have given a shear action, but in the depression which was almost in the center of the premolars. Mr. Friel had drawn some excellent diagrams showing that relationship as well as his conception of occlusion, and they would prove an interesting study in combination with the paper. Another interesting point was that when there was a very deep overbite there was a great lack of shear action in the molar region. On the other hand, he rather gathered that Mr. Shaw's view was that shear operated before the teeth came into contact; he would like to know how much excessive overbite there must be before the shearing action was rendered ineffective. He also wished to thank Mr. Shaw for the great work he had put into the subject.

*Mr. Watkins* said that considering the length of life of the permanent dentition, about sixty years, the attrition was not very great on the surface, which seemed to confirm Mr. Shaw's contention that the teeth did not rub on each other. They had been more or less taught in prosthetics that the teeth slid one on each other more or less to balance the bite, but it seemed to him that was not the case in natural dentition and that the food between the teeth kept the teeth apart except at the point where the teeth were being brought together to break the food into fragments.

*Mr. Lindsay* said he should imagine that while members might accept with great interest and gratitude Mr. Shaw's description of the mechanical action in connection with the comminution of food, they would be somewhat chary of accepting his deductions from the conditions he found in mammalian dentition today in connection with development. With regard to maximum shear, perhaps it was unfortunate, as Mr. Northcroft had said, to have to reform ideas as to what shear was, but he thought it might be taken that after all there was something more in the definition shear than mere cutting and that it comprised very largely not only cutting action but grinding and percussive action, and that it might be very accurately described as the actual mechanical force involved in mastication. He agreed with Mr. Northcroft that Mr. Shaw had got himself into a slight difficulty in his quarrel with the edge-to-edge bite, if he had to look upon the present condition as the latest developmental result of a long series of experiments on the part of Nature to produce the most efficient masticating apparatus. He noted that he discussed the question from the point of view of the present deciduous dentition. He did not know whether there was any historical or prehistorical data as to the nature of the deciduous dentition of man, and, therefore, he would suggest that Mr. Shaw was on rather dangerous ground in the majority of his deductions. For example, would it not be suggested that a very large amount of protection was afforded to the delicate gums by the ordinary masticatory influences of the mouth, the saliva and the action of the tongue and cheek and lips? It seemed a little dangerous to suggest, as he thought Mr. Shaw suggested, that the shapes of the teeth were necessarily evolved from the gum-protecting idea. The paper had a very definite orthodontic significance. It seemed to him the function of the Society now to maintain the maximum condition of efficient mastication. He could not entirely agree with Mr. Shaw that function was the sole care of Nature. After all, a man did not live by bread alone, and Nature occasionally went out of her way in order to produce beautiful effects.

*Mr. Shaw* said he was very gratified at the discussion, which was better than he had hoped for. He was glad to think that Mr. Pitts believed there was something in the conception of maximum shear that was well worth following up. Mr. Northcroft had spoken of the use of the terms "shear" and "grinding." He had no intention of displacing the useful and handy word grinding, but when one came to apply one's knowl-

edge of science, one realized that there was the science of mechanics which must be applicable to teeth and must to a certain extent be put forward just as it was and is put forward by all the great physicists and engineers. There was no difference of opinion as to the term grinding. Even the grinding of a pestle in a mortar was, with some substances, in its essence mainly a shear action, but his concept of "shear" applied correctly to all the different types of teeth.

*Mr. Northcroft* said that that was triturating. He had only appealed for a correct use of terms. Johnson made it a great point in his papers that new terms should not be introduced, but terms should be used that had a definite meaning.

*Mr. Shaw* said although it might seem doubtful to Mr. Northcroft it was one of the things which he was very keen to bring about, a clear definition of terms and their meanings. In the front teeth most people agreed it was nearly a pure shear action and in the canines it was pretty much the same and largely so in the premolars. His conception of the use of the term shear, especially maximum shear, was in a short phrase to denote a *leading mechanical principle* that ran through a very large number of dentitions in animal forms. There seemed to be an idea that the edge-to-edge was superior to overlapping. Why was not there the same desire to have this same edge-to-edge occlusion a little further back than the incisors or canines? Why not also with the premolars or molars? Mr. Chapman had referred to the analysis of the various functional elements of the premolars. In the paper it was said that there was shearing action on the buccal cusps, and the lingual cusps had as their prime function helping the tongue in food holding. As the teeth came together the food in the very small spaces would be subject to actions which he could not analyze. He did not indicate in his paper in any way that, in cases of malocclusion, shear action was abolished altogether, but that it was simply depreciated. There were plenty of cases in which such a thing could be seen if the jaws were examined at a position when just about passing in a masticating stroke. He had seen a good many cases where the premolars and molars, by a space of one-sixteenth of an inch, were prevented, when passing one another, from coming into contact at all.

*The President*, on behalf of the Society, thanked the author for his paper, and those who had taken part in the discussion.

# A SURVEY OF TEN YEARS OF ORTHODONTIC PRACTICE*

By Frank A. Delabarre, A.B., D.D.S., M.D., Boston, Mass.

MORE than ten years ago I began to keep accurate records of the various steps of my work in the endeavor to improve the quality of service given, with the hope that sufficient data in time would be gathered for study. The results of that study have justified the effort and are presented herein, with a full understanding that differences in technic and practice make them of lesser value to anyone else; but you may be assured that similar investigations of your own would disclose many things of interest and importance.

The underlying policy of this practice has been that of prevention, following Bogue's teachings. The ultimate goal is a close adherence to the strictest principles of prevention possible of application, going back in point

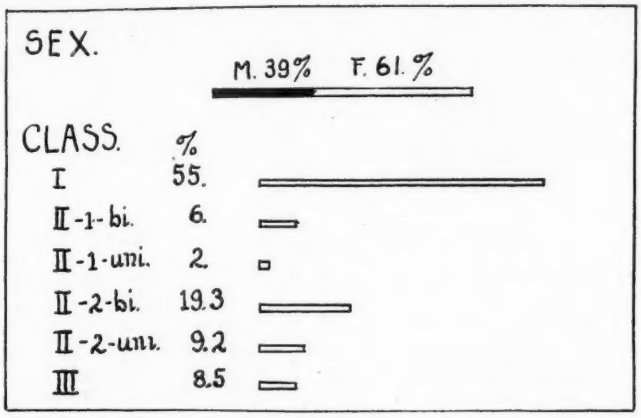



Fig. 1.

of time to the expectant mother, taking advantage of every means to insure a good physical equipment for the child, and eliminating all known factors that might tend to maldevelopment.

The following explanation of office routine will make the data more clear:

The first examination of a patient includes taking the case history, study of mouth conditions and securing impressions. Before the second appointment the following items should have been attended to: study of the models and case, writing out a definite line of treatment with the succession of operative steps indicated, and an estimate of the months required and the hours necessary for chair and laboratory work.

Almost all appliances are made by the indirect method, in order to shorten the chair time for young patients, and the laboratory has its own appointment list.

The sex ratio is male 39 per cent, female 61 per cent.

*Read before the New York Society of Orthodontists, February 27, 1924.

The classification of cases (Angle) gives the following:

| | per cent |
|---|---|
| Class I | 55. |
| " II-1-bi. | 6. |
| " II-1-uni. | 2. |
| " II-2-bi. | 19.3 |
| " II-2-uni. | 9.2 |
| " III | 8.5 |

It should be said, in explanation of the diagnosis of the divisions of Class II cases, that if the line of treatment calls for a forward movement of

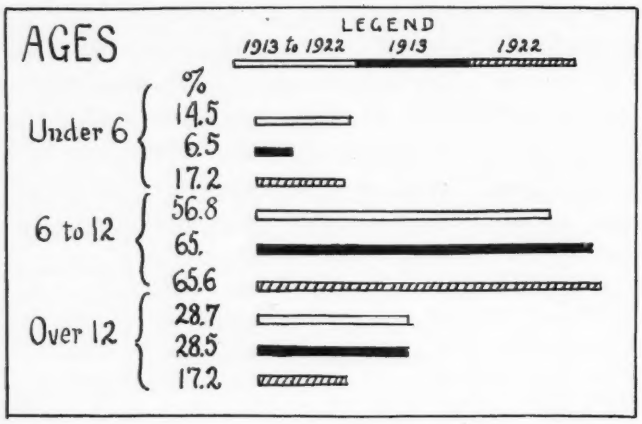



Fig. 2.

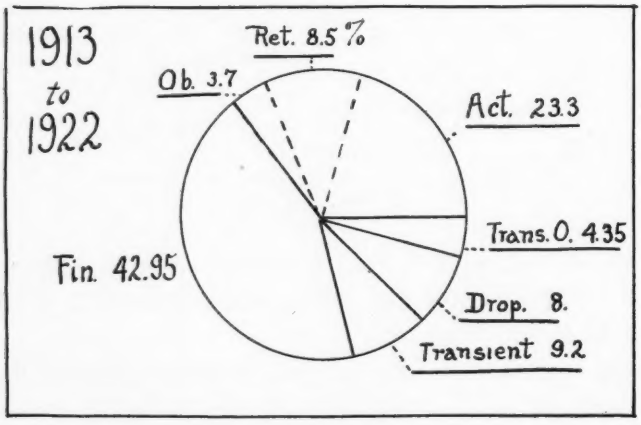



Fig. 3.

*any* of the maxillary incisors the case is listed in division 2; otherwise in division 1.

The average age of all cases, at the time of starting, was thirteen years, eleven months. The oldest case was twenty-seven years, and the youngest three years.

Dividing them into three groups, "under 6," "6 to 12," and "over 12," and comparing the years 1913 and 1922 in connection with the same data for the ten year period, it develops that the "under 6" group in 1922 is 10.7 per

cent greater than in 1913, and 2.7 per cent more than for the entire period; the "6 to 12" shows a similar change to a much less degree, and the "over 12" group shows a decrease of 10 per cent for 1922 as compared to either period. This shows that the age limit is being brought down, slowly to be sure, to conform to the principles of prevention.

This is again confirmed in studying the examination. Of all cases examined 43.8 per cent had the work started.

In 1923, 67.3 per cent were accepted, 15.2 per cent were refused, and 13 per cent stopped with the examination. The reason for refusal was mainly because a definite improvement result could not be prognosed that would justify the expenditure of time and money, even under a compromise treatment. These cases were all over twelve years of age.

The balance sheet showing the present state of the practice shows:

| | | per cent |
|---|---|---|
| Finished | | 42.95 |
| Active | 23.3 | |
| Retainer | 8.5 | |
| Observation | 3.7 | 35.5 |
| Transferred In | | 9.2 |
| Dropped | | 8. |
| Transferred Out | | 4.35 |

The growth by years is shown in the graph, the items being total cases, new cases and finished cases.

The drop in total cases for 1922 is partly accounted for by the previous decrease in the number of new cases, and the increase of finished cases. Extension to include 1923 shows a recovery from the depression.

Cases have been referred by the professions 49.1 per cent and by previous patients 50.9 per cent.

Analysis of the time element of the finished cases shows that it took 42.5 months on the average to complete a case; 33.19 hours of chair and laboratory work in 44.7 sittings, each averaging 33.5 minutes.

A close study of these figures will give a greater degree of accuracy in future estimates. For instance, take the average hours per case, 33.5, and divide it into the 29 per cent laboratory, which equals 9.5 hours and 71 per cent chair, or 23.5 hours. Now ask the question, "How many hours does it take to start a case with both appliances on?" My averages show a total of 10.5 hours divided as follows:

| | |
|---|---|
| Laboratory | 5.5 hr. |
| Study | 1.5 hr. |
| Chair | 3.5 hr. |
| | 10.5 hr. |

That amounts to 31.6 per cent of the average total hours to be spent on the case and the work is only started. It seems to be out of proportion and excessive but it cannot be figured any other way from the data. There remain four hours for laboratory work during the rest of the case. According to the schedule of appointments in use, 16.5 additional hours are required for chair work and this leaves two hours to be devoted to the study of the case during its progress.

These figures give the foundation, when coupled with overhead and cost of materials, for a close estimate of what it *costs* the operator in time and money to carry on any given case.

There is such a remarkable uniformity in the chart comparing the chair and laboratory hours from four different angles that it may be considered

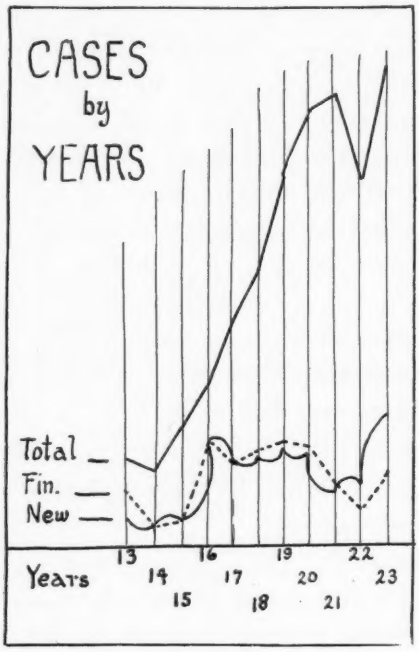



Fig. 4.

SOURCE

| | |
|---|---|
| Referred by M.D. or D.D.S. | 49.1% |
| " " Patients | 50.9 |

TIME AVERAGES, "F" CASES

| | |
|---|---|
| Avg. No. Mos. | 42.5 |
| " " Hrs. | 33.19 |
| " " App't's. | 44.7 |
| " Min. per " | 33.5 |

Fig. 5.

standard in this practice, that, of the total hours used in any given case, 29 per cent must be devoted to laboratory work.

The largest Bogue index was 38 mm., the smallest 21 mm., and the average 26.8 mm.

In considering cases with nervous symptoms, only those are so listed which were of such a nature that a physician had been consulted in regard

to them. Thirteen per cent of all the cases are in this list. The range ran all the way from the simply "nervous" child, through chorea to epilepsy, cretinism and dementia precox.

Up to the present time a very large percentage of such cases have been definitely cured through orthodontic treatment by relieving the nervous shock and tension occasioned by the crowded or impacted condition of the teeth.

The figures are very conservative and are supplemented by experience with a much larger group of children who have not been afflicted severely

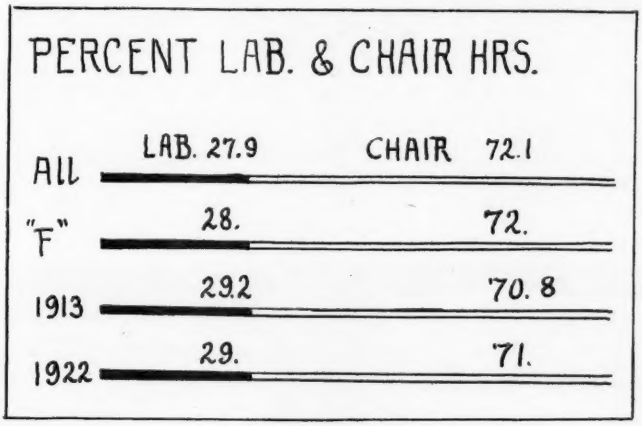



Fig. 6.

enough to be classed as anything but "nervous temperament." In answer to the frequent question of the anxious mother of such children, "Is not the nervous strain of your work going to be too great for my child?" it can be truthfully said that the "nervous" child becomes less nervous during orthodontic work, provided it is done slowly, without pain, and in sympathy with the patient.

More data from varied sources is needed on this important subject and it is sincerely hoped that some representative organization will undertake to assemble and tabulate it.

# CLASS I (ANGLE) WITH MAXILLARY INCISORS OCCLUDING LINGUALLY TO THE MANDIBULAR INCISORS IN A PATIENT TWENTY-FIVE YEARS OF AGE* (FROM THE PRACTICE OF DR. A. H. KETCHAM)

By William R. Humphrey, M.D., Denver, Colo.

THE case which I report is that of a young lady twenty-five years of age, having a Class I (Angle's Classification) malocclusion. (Fig. 1.)

The first impression gained might raise a question in the mind of the observer, as to the correctness of this classification, as the mandibular first

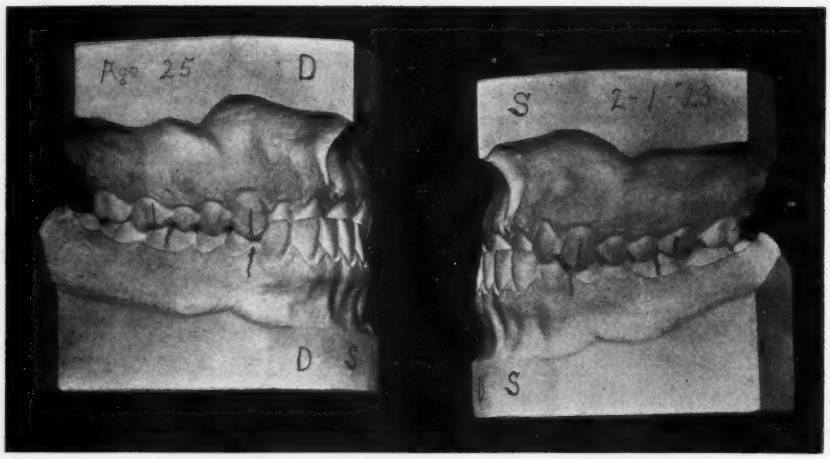



Fig. 1.

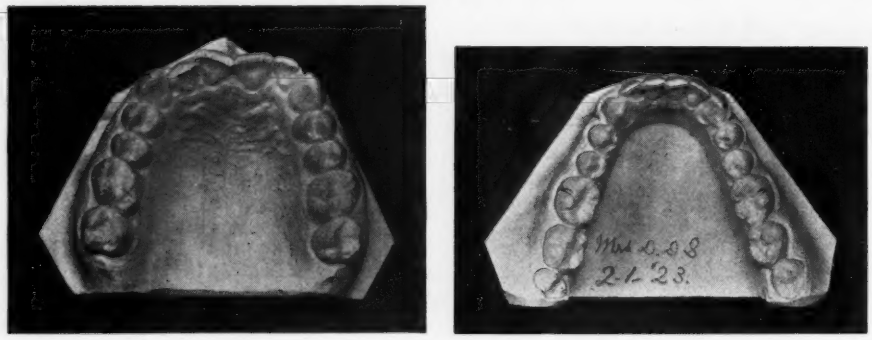



Fig. 2.

molars appears to be in mesioclusion. However, a careful study of the inclined surfaces of the cusps, especially the lingual cusps of the buccal teeth when in occlusion, show that the majority are under normal influence. The

*Case report read before the American Society of Orthodontists March, 1924, at Kansas City, Missouri.

maxillary incisors are retruding, occluding lingually to the mandibular incisors, with the arch flattened in this region. The mandibular arch is elongated and narrow in premolar and canine region. (Fig. 2.)

The radiograms show that the maxillary third molars are absent, therefore extraction of the mandibular third molars, which are present, is indicated.

In selecting appliances to treat this case, efficiency was the first con-

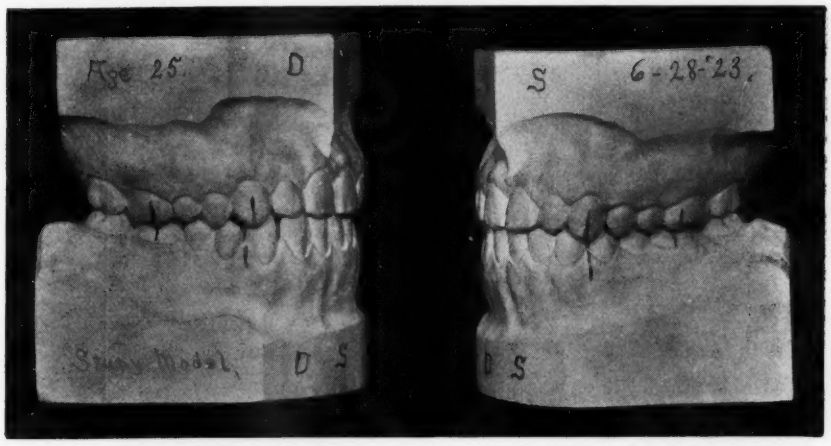



Fig. 3.

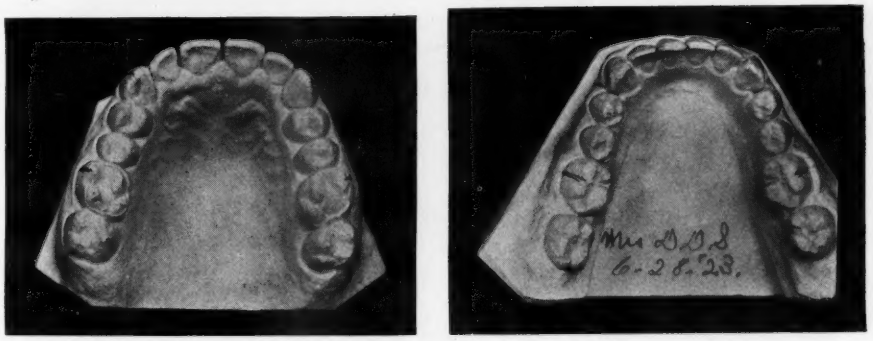



Fig. 4.

sideration, simplicity and inconspicuousness the second; so the well-known lingual appliance with auxiliary springs, as developed by Mershon, with the Young lock, was used on the maxillary teeth, as it would best serve our purpose, in this case, in moving the maxillary incisors labially.

The rotation of the maxillary incisors was accomplished through the use of double loop silk ligatures passed around these teeth and tied to the auxiliary springs on the lingual side.

In the mandibular arch, the tooth movement to be gained, is a moderate degree of expansion in the premolar and canine region, and lingual movement of the incisors, with rotation of the right central and left lateral. To accomplish this result the ribbon arch and bracket band appliance was chosen so that the desired tooth movement could be accomplished in the most efficient manner, without lingual tipping of the crowns of the incisors,

as is so often the case when other types of appliances are used. Bracket bands were placed upon the six mandibular anterior teeth and plain anchorage bands carrying regular curved sheaths upon the first molars. Hooks for the intermaxillary ligatures, as used in regular Class III (Angle) technic, were placed upon the ribbon arch at a point near the first premolars.

The intermaxillary ligatures were used as an auxiliary force from the hooks upon the ribbon arch to hooks placed upon the buccal surfaces of the

Fig. 5.

Fig. 6.

maxillary first molar anchorage bands. The reason for this auxiliary force, is to overcome any tendency which the maxillary molars might have to tip or move distally—due to the resistance offered by the anchor teeth being less than resistance offered by the lingually locked maxillary incisors. Then too, the aid of the intermaxillary ligatures is valuable in moving the mandibular incisors lingually and in establishing correct occlusion of the maxillary and mandibular teeth.

In this case of comparatively advanced age, the active treatment covered

less than five months time. The result at the end of this period is shown. (See Figs. 3 and 4.)

The only artificial retaining devices used upon this case, were bands to prevent rotation of the mandibular right central and left lateral incisors. The occlusion of the mandibular incisors retained the maxillary incisors.

At present, nine months after the active period of treatment, the teeth show continued improvement. The improvement in the facial expression is shown by the photographs (See Figs. 5 and 6).

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## REPORT OF CASE*

By B. Frank Gray, D.D.S., San Francisco, Calif.

I AM sure those who see the figures illustrating this case will agree I am not presenting it because of completeness of result or to demonstrate any ideal orthodontic procedure. I am showing the work that has been accomplished in a particularly difficult and anomalous condition, thinking it might

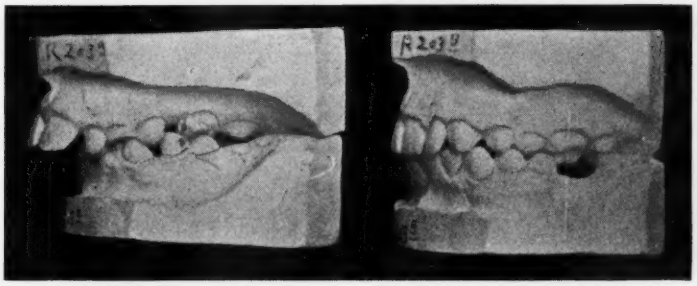

Fig. 1.

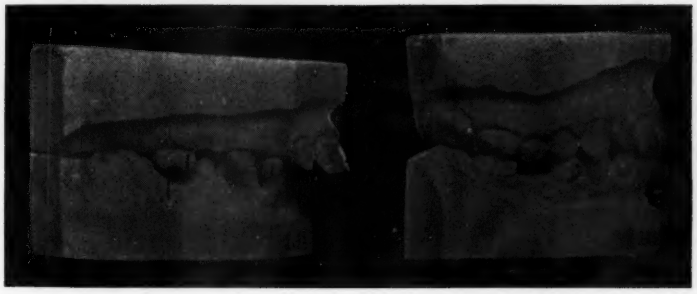

Fig. 2.

be of interest. Indeed if it may call forth some discussion and suggestions as to a better procedure, that would be of interest and of help to us all.

To add to the perplexity of the problem, the mandibular first permanent molars had been so seriously neglected that their remnants had to be removed.

*Read before the American Society of Orthodontists, Kansas City, Mo., March 18-21, 1924.

From Figs. 1 and 2 the posterior relation of the mandibular teeth to those of the maxillary arch on either side will be noted. It will be further noted that the mandibular teeth of the left side were allowed to remain in a posterior relation, and this inharmony continues around the arch and includes the premolar teeth of the right side. Although the mandibular right second molar

Fig. 3.

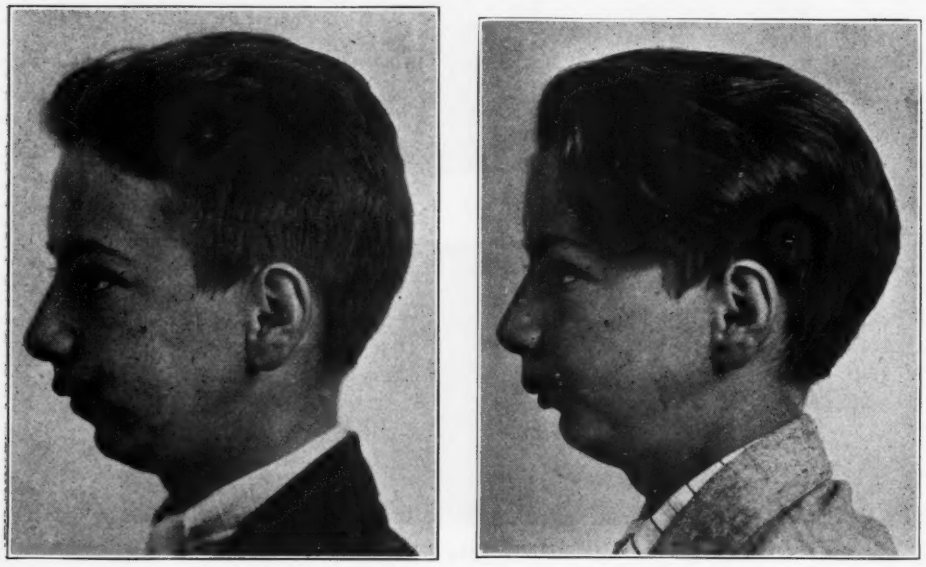

Fig. 4.

has been made to occupy approximately the position of the first permanent molar, a space the width of the first permanent molar still remains. Some further adjustments are being made on the right side to improve the occlusion of the teeth.

The retention of the tooth in such a case is as difficult as the other fea-

tures connected with this anomalous condition. In brief the patient is wearing a vulcanite plate in the mandibular arch, carrying substitute teeth for the extracted first permanent molars. This plate maintains the form of the arch, a matter of prime importance. It is expected a more hygienic prosthetic piece may be substituted for the vulcanite later on.

The maxillary arch is also maintained by a "Hawley Retaining Plate." In due time it is believed this may be dispensed with, depending wholly upon maintaining the harmonious contour of the mandibular arch for the retention of the two dentures.

The photographs of this lad, made at fourteen years of age and again at seventeen, present an unusual facial distortion. You may agree that some

Fig. 5.

improvement has been secured, but it is not so marked as we would like. It was obvious at the outset that the facial inharmony was due in part only to malocclusion of the teeth. An examination by a well-known orthopedic surgeon, supported by radiographic examination, secured the following diagnosis: "Absence of the articular process of the left lower mandible. Neither Doctor ——— nor myself could say whether this was due to disease or to injury or was simply a congenital defect. Nothing, it seems to me, should be attempted surgically" The father of the lad, who is a physician, has been quite unable to account for this condition with any accurate information.

Complicated by his distant residence from San Francisco, I am unable to show creditable radiographic evidence at this time, but I shall include suitable illustrations when this report is published. The slide from which Fig. 6 was made met with a mishap, as will be noted. It may indicate in a poor way, an anomalous condition of the condyle of the left side, as stated by the orthopedic surgeon quoted above. The one unfortunate thing I believe, however, is the fact that unsatisfactory radiographic pictures were secured in the first place, indicating the unwisdom of depending upon even

the best radiographic laboratories. In this instance the original examination was made by or under the direction of a famous radiographer, but the results were certainly most questionable. I have learned that even though the temporomandibular region is a difficult location to radiograph, I shall be able myself to present good illustrations as stated, when this report is published.

**Fig. 6.**

In conclusion, it appears the anomalous condition of the articular process as noted may account for a shifting of the whole body of the mandible toward the left, thus accounting for the seriously defective aspect of the face on the right side. Granting that we may be able to maintain the contour of the dental arches, it would appear the best additional hope this young man may have for future comeliness will be the cultivation of a vigorous and well trained beard.

# *DEPARTMENT OF*
# *ORAL SURGERY AND SURGICAL ORTHODONTIA*



## SO-CALLED SURGICAL TREATMENT OF PYORRHEA ALVEOLARIS

By Wallace C. Shearer, D.D.S., Portland, Oregon

FIGURE 1 is a reproduction by actual photograph. Observe the congested tissues; pus oozing from the gingival margin; clinically the teeth are loose due to the in-roads made at the gingival margin caused by hypertrophied gums; sloughing.

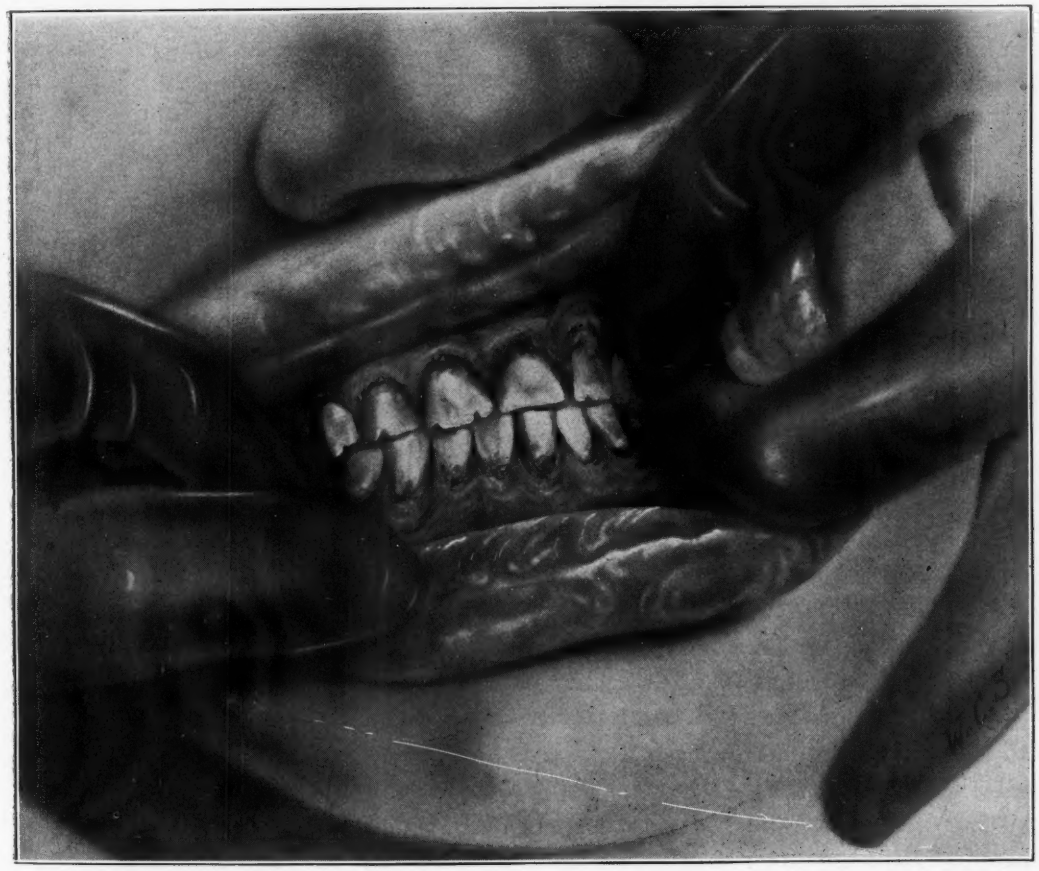

**Fig. 1.—March 23, 1922. Maxillaries operated March 23. Mandibulars, April 1.**

Fig. 2. The Zentler flap is lifted by first making two incisions extending from the gingival margin to the reflection of the cheek, involving three teeth. Then the tissue in the interproximal space is cut and the mucoperiosteum is reflected as high as indicated in the cut. This operation was designed by Arthur K. Zentler of Columbia University.

Fig. 3 shows the operation completed. This is simply the result of removing the low grade bone presented with its rough edges and sharp spicula,

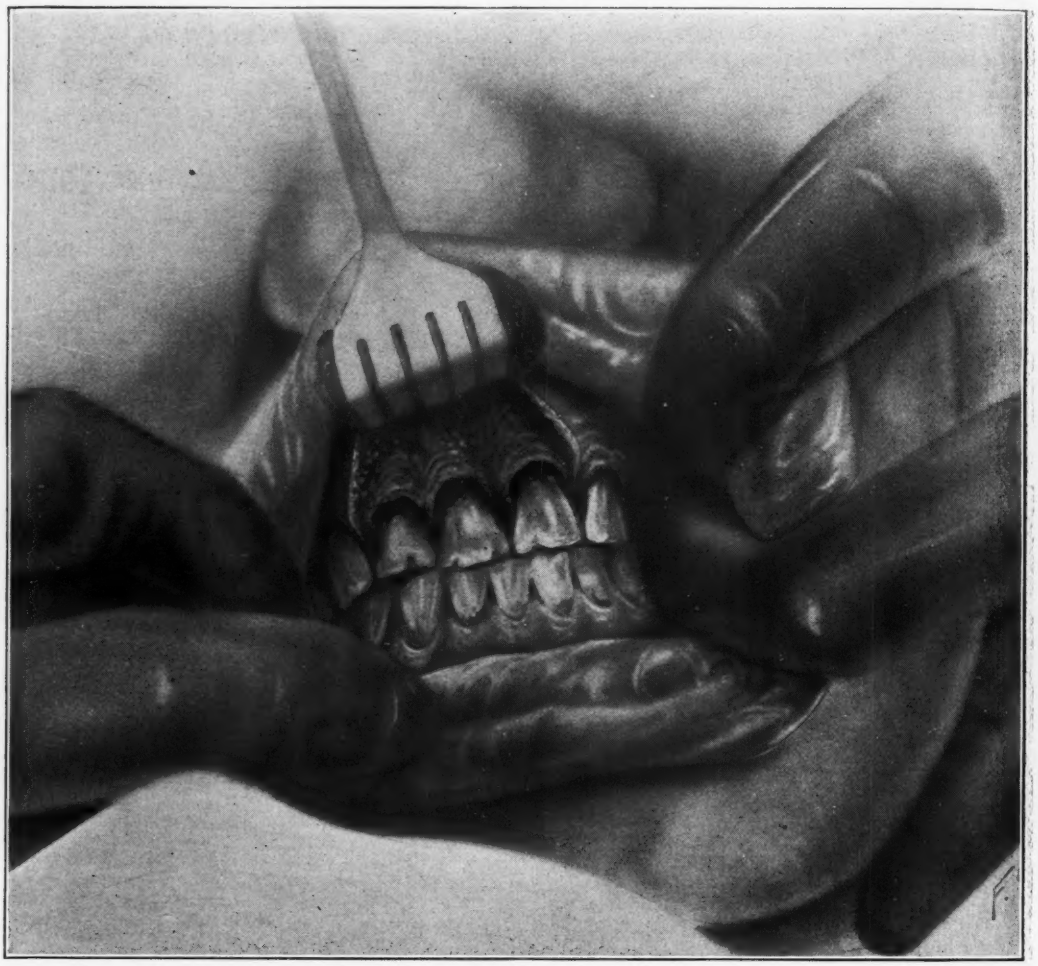

Fig. 2.—Zentler Flap Operation, No. 1.

as illustrated in Fig. 4, which is an extended yet modified operation as carried out by the Zentler method.

Note that in Fig. 4, the mucoperiosteum is not reflected to the extent such as is illustrated in Fig. 3, but just to the seat of the infection or over the bulging crest of the alveolar tissue. By not reflecting the mucoperiosteum to the extent of the Zentler method it is possible to extend the operation over all the teeth either in the maxillary or the mandibular jaw at the same sitting. The pathologic tissue may be entirely removed and the mucoperiosteum replaced after freshening the edges of the tissue coming in contact with the gingival margin of the teeth. After the edges are freshened and

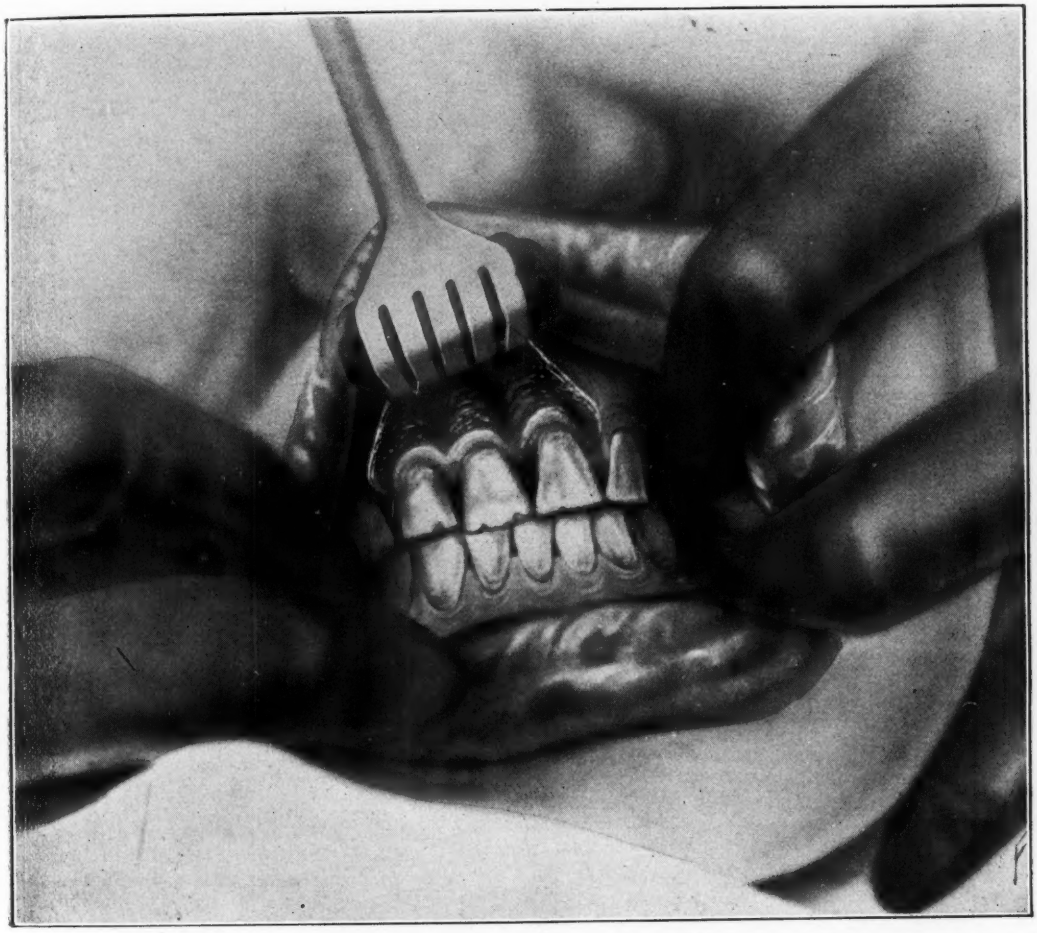

Fig. 3.—Zentler Flap Operation, No. 2.

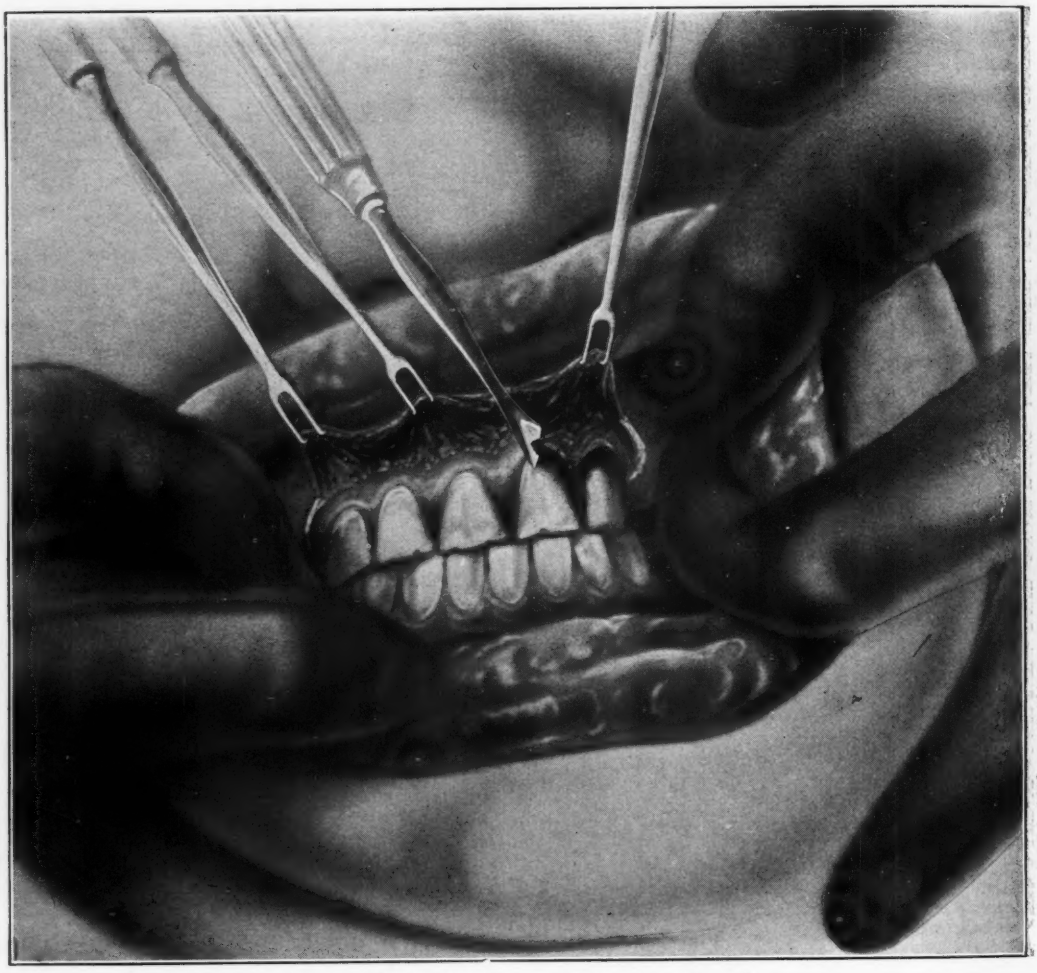

**Fig. 4.—Improved technic for Zentler Flap Operation.**

the tissue placed in apposition with the healthy bone and sutured interproximally, a healing by first intention is accomplished.

Fig. 5. Note the tissue one week after the modified operation.

Fig. 6. Note the tissue in healthy condition twenty-six days from the day of operation. All pus is eliminated; there is no hypertrophied condition, no "V"-shaped space to fill with infectious tissue; no sensitive teeth but a clean healthy mouth and a satisfied patient.

*Conclusion.*—To do this operation, sharp instruments must be used causing little or no trauma. While the mucoperiosteum is reflected, serumal calculi and overhanging edges of fillings may be removed hastily and accu-

Fig. 5.—Maxillaries one week after Zentler Flap Operation.

rately. It is necessary, however, that all debris and foreign particles be removed before the operation is begun in order to have a clean field.

The principal objection to the Zentler flap operation is that only three or four teeth can be operated upon at one time, necessitating a prolonged operation of about a month and resulting in a sore mouth all that time, while with the extended modified flap we are able to do a complete operation at two sittings, one week apart.

### PROPHYLAXIS SHOULD BE MAINTAINED

All banded crowns and all bridges with banded crowns should be removed before the operation. The occlusion should be made perfect either before or after the surgical work. Complete instructions should be given

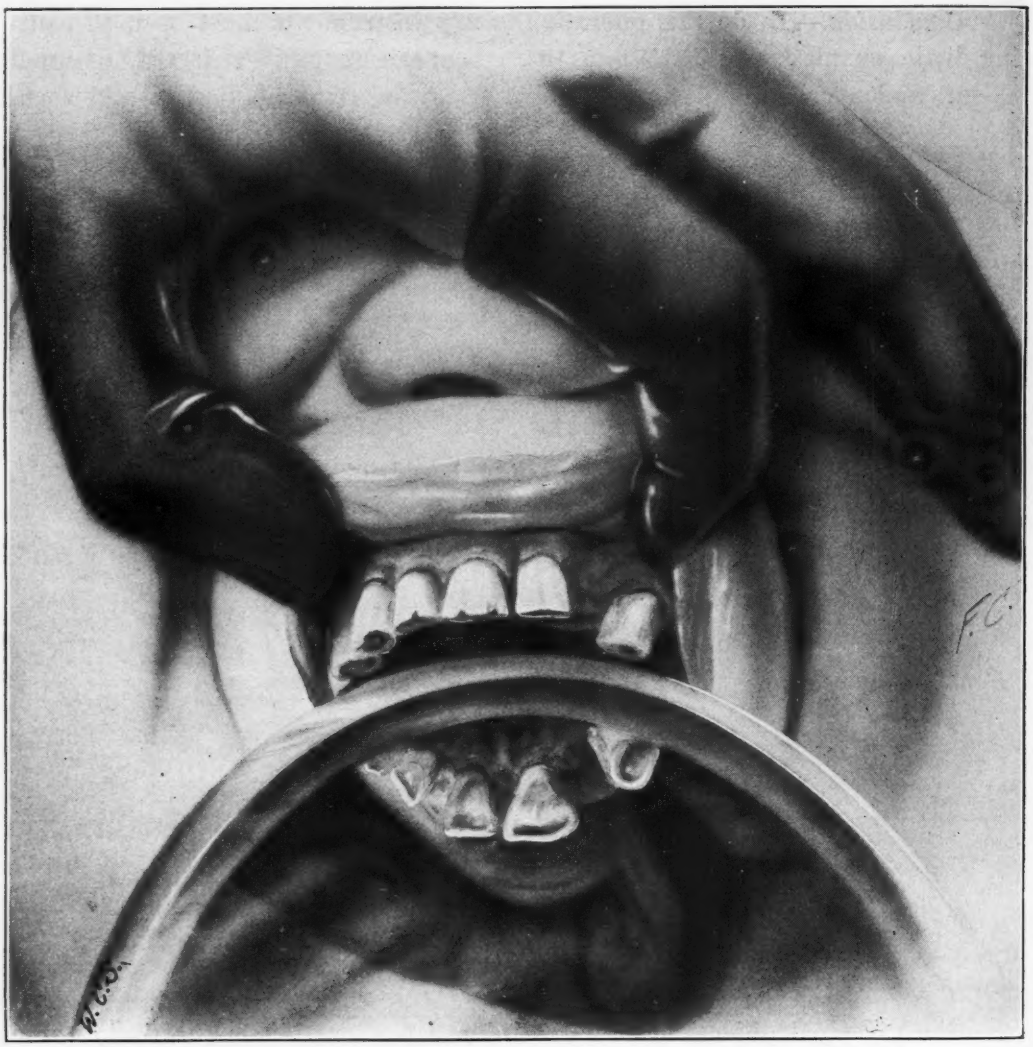

**Fig. 6.—April 27, 1922. Maxillary gingival area 26 days after operation.**

the patient as to how to prevent the return by the use of dental floss and the mechanical use of tooth paste.

From a scientific standpoint the healthy bone tissue, having been brought

Fig. 6-A.—Maxillary gingival area 26 days after operation.

in contact with the mucoperiosteum which contains all the bone building properties known as the osteogenetic layer with its odontoblasts, unite, after all mechanical irritation and perceptible infection has been obliterated.

# *DEPARTMENT OF*
# *DENTAL AND ORAL RADIOGRAPHY*

**Edited By**
**Clarence O. Simpson, M.D., D.D.S., F.A.C.D.,**
**and Howard R. Raper, D.D.S., F.A.C.D.**

## THE TECHNIC OF ORAL RADIOGRAPHY

By Dr. Clarence O. Simpson, St. Louis, Mo.

### SINUS EXAMINATIONS

#### Lateral View

(*Continued from page* 664.)

*Placement of Cassette.*—With the arm of the operating chair removed, the patient is directed to turn until the side of the head is toward the head rest. The cassette in a vertical position is rested against the head rest.

*Retention of Cassette.*—Supported by the patient's shoulder and nearer hand. Immobility promoted by a tight bandage around patient's head, cassette, and head rest.

*Position of Head.*—Sagittal plane vertical, and parallel with cassette.

*Anteroposterior Angle of Projection.*—Perpendicular to cassette.

*Verticohorizontal Angle of Projection.*—Perpendicular to cassette, or horizontal.

*Cone.*—Centered at external margin of the orbit.

*Spark Gap.*—5 inches.

*Exposure.*—80 to 120 milliampere seconds at a 40 inch target-film distance, with double coated films and intensifying screens.

#### Anteroposterior View of Maxillary Sinuses

*Placement of Cassette.*—Horizontal, or inclined ten degrees toward patient when there is difficulty in posing.

*Retention of Cassette.*—Supported by a stand or table.

*Position of Head.*—Sagittal plane vertical, forehead on cassette, and nose pressed tightly against cassette. Immobility promoted by head clamps, or a tight bandage around patient's head and cassette.

*Anteroposterior Angle of Projection.*—Perpendicular to cassette.

*Modifications.* Five degrees or more above or below perpendicular as the average position of the head is changed by the facial profile, and the size and compressibility of the nose. Five or ten degrees below perpendicular for children.

*Lateral Angle of Projection.*—Perpendicular to cassette.

*Cone.*—Centered just below the occipital protuberance.

*Spark Gap.*—5 inches.

*Exposure.*—80 to 120 milliampere seconds at a 30 inch target-film distance, with double coated films and intensifying screens.

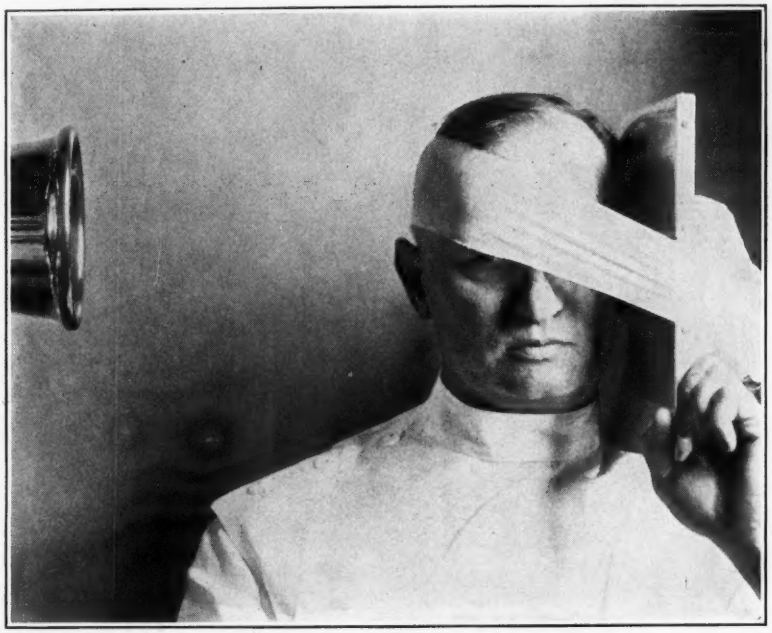

**Fig. 1.—Position of patient, cassette, and cone for a lateral examination of the paranasal sinuses.**

### Anteroposterior View of Frontal Sinuses

*Placement of Cassette.*—Horizontal, or inclined ten degrees toward patient when there is difficulty in posing.

*Retention of Cassette.*—Supported by a stand or table.

*Position of Head.*—Sagittal plane vertical, forehead on cassette, and nose pressed tightly against cassette. Immobility promoted by head clamps, or a tight bandage around patient's head and cassette.

*Anteroposterior Angle of Projection.*—Fifteen degrees above perpendicular to the cassette.

*Modifications.* Ten to twenty degrees above perpendicular as the average position of the head is changed by the facial profile, and the size and compressibility of the nose.

*Lateral Angle of Projection.*—Perpendicular to the cassette.

*Cone.*—Centered at juncture of the occipital and parietal bones.

*Spark Gap.*—5½ inches.

***Exposure.***—100 to 140 milliampere seconds at a 30 inch target-film distance, with double coated film and intensifying screens.

**Special Examination of Sphenoidal Sinuses**

***Position of Head.***—Occlusal plans of maxillary teeth horizontal. Head supported by head rest.

***Anteroposterior Angle of Projection.***—Twelve degrees posterior to vertical. ***Modification.*** Ten to twenty degrees posterior to vertical depending upon the tolerance of the patient for insertion of the cassette.

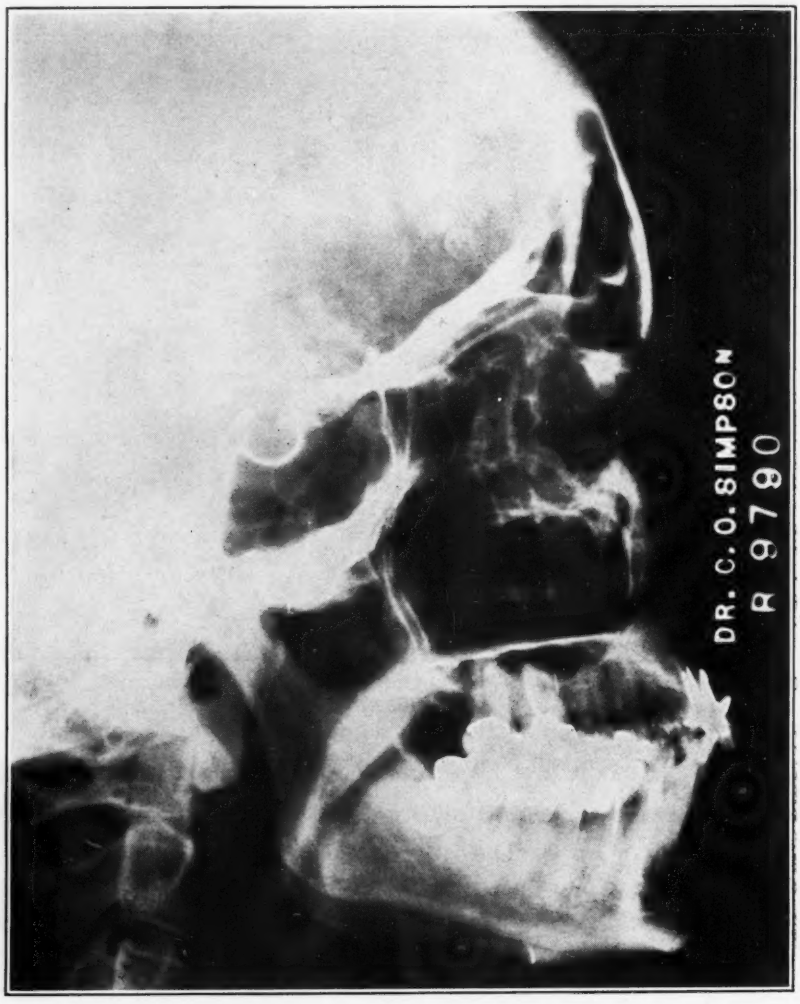


**Fig. 2.**—A lateral view of the paranasal sinuses.

***Lateral Angle of Projection.***—Vertical.

***Placement of Cassette.***—With the tube and head in position, and the mouth open, gently insert the cassette as far posteriorly in the pharynx as it can be endured.

***Retention of Cassette.***—Firm pressure of the teeth on cassette, immediately after placement.

*Cone.*—Centered at the juncture of the frontal and parietal bones.
*Spark Gap.*—4½ inches.
*Exposure.*—40 to 60 milliampere seconds at a 20 inch target-film distance, with double coated films and intensifying screens.

*Explanatory Description.*—The proximity of the accessory nasal sinuses to the mouth, the relation of sinus and oral diagnosis, and the lack of systematic technic in sinus radiography warrants a chapter on sinus examinations in this series. The technic here described is based on the fundamental

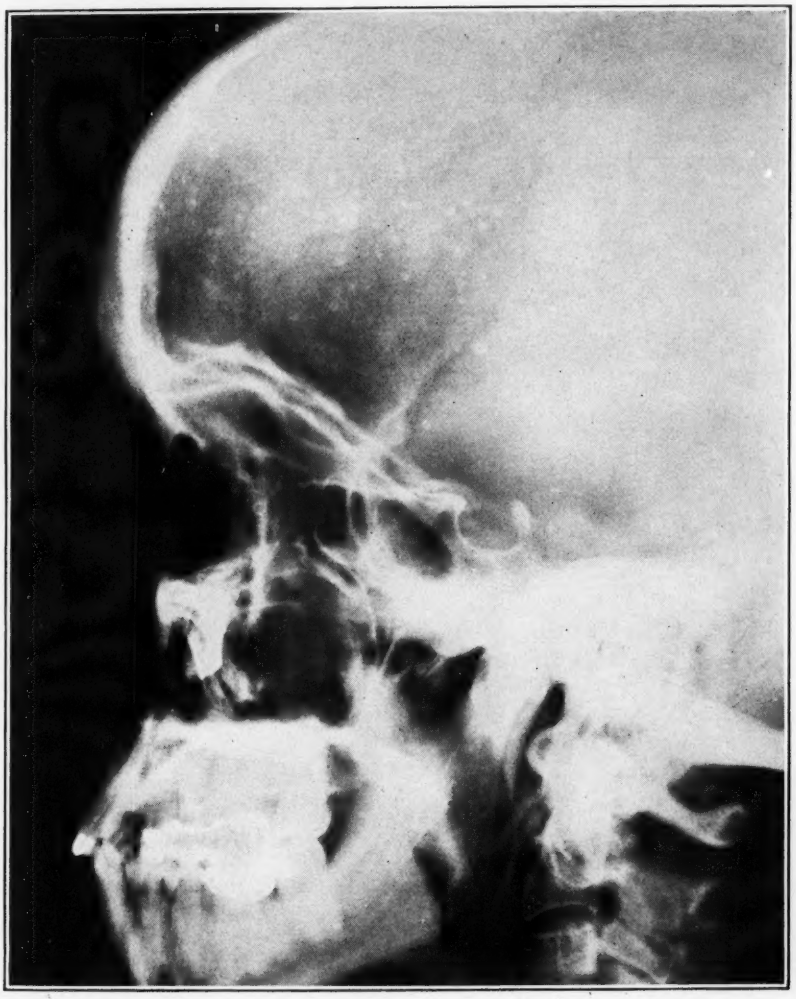

Fig. 3.—A lateral view demonstrating the absence of frontal sinuses.

principle of placing the region to be examined in the closest possible relation to the film, and presents no restriction on the angle of projection. The common error of limiting a sinus examination to one view, and attempting to diagnose conditions from this inadequate evidence is a reflection on the efficiency of radiographers, and among rhinologists has brought radiography into disrepute as a diagnostic aid.

The three routine views described should be the minimum requirement in a radiographic examination of the paranasal sinuses. The lateral view

shows the anteroposterior extent of the maxillary and sphenoid sinuses, and is indispensable for a thorough examination of the frontal sinuses by revealing the depth and thickness of the walls. Without the lateral view, average bilateral radiolucence in the anteroposterior view would be interpreted as normal while it may be significant of disease in deep frontal sinuses with thin walls, and radiopacity of varying degree may be entirely due to anatomic factors. To obtain reliable information from this view, the technic must be accurate in producing correct perspective. The endeavor should be to sharply project the sagittal section of the accessory sinus region without distortion or avoidable superimposition. Therefore the rather long target-film distance recommended is one of the essential factors in this examina-

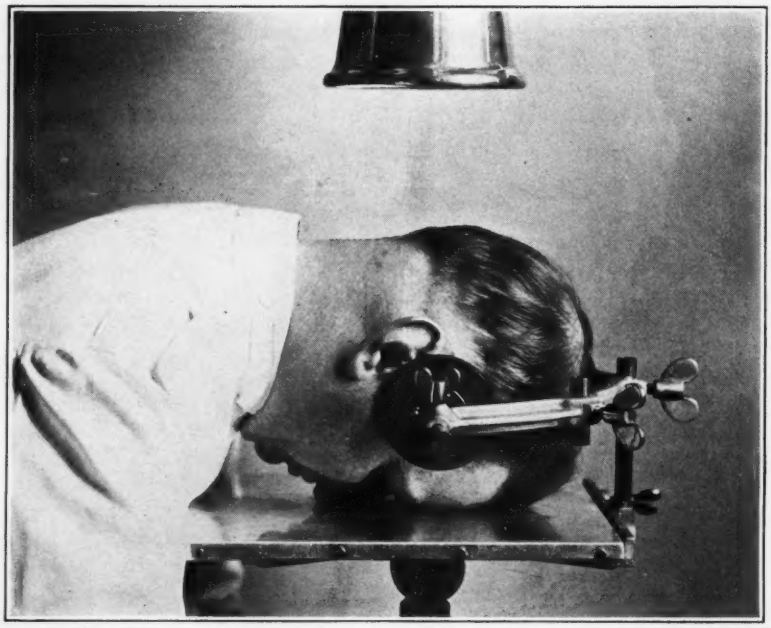

**Fig. 4.—Position of patient, cassette, and cone for an anteroposterior examination of the maxillary sinuses.**

tion. The coincidence of the orbits is an accurate check on perspective of this view rather than the mandible or other more obvious landmarks.

One anteroposterior view is required for the maxillary sinuses, and another for the frontal sinuses because both regions cannot be shown to the best advantage in one view. The maxillary sinuses are most clearly revealed by projecting the occipital bone and the petrous portion of the temporal bone just above these sinuses. In this view the frontal sinuses are foreshortened and insufficiently exposed, because more penetration and exposure are required to penetrate the cranial bones than the cervical and facial structures. For dependable information the anteroposterior view of the maxillary sinuses must parallel the sagittal plane, or there will be a difference in the apparent radiolucence of normal sinuses because the adjacent structures are not uniformly superimposed. The sagittal plane may be placed vertically by level-


Fig. 5.—An anteroposterior view of the maxillary sinuses.

ing the posterior attachment of the external ears. This is easily done by standing behind the patient after the head is on the cassette, folding the pinnae forward and viewing the posterior surface of the conchae as they are leveled. The accuracy of projection in the sagittal plane can be verified in the negative by the equality of the triangular areas bounded by the internal surface of the mandible, and the alveolar and malar processes of the maxillae with allowance for an unilateral edentulous molar region.

The latitude in the verticohorizontal angle of projection is occasioned by the difference in facial profiles and the size and compressibility of noses. Close observation of the relation of the profile to the cassette and palpation of the occipital protuberance will enable the operator to estimate the deviation indicated from the average angle of projection. With a definite pose

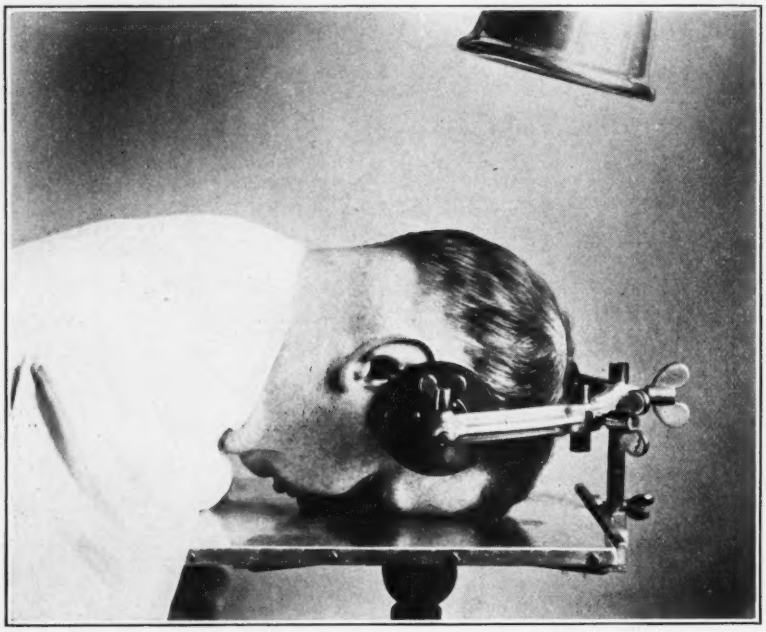

**Fig. 6.—Position of patient, cassette, and cone for an anteroposterior examination of the frontal sinuses.**

and angle of projection an error in calculation can be corrected in subsequent exposures by a deliberate change in the angle of projection. Any technic for radiographic examination of the sinuses in which the face is rested on the cassette should be modified for variations in profiles. Ignoring facial contour is the absurdity and factor of error, in the alleged classic methods of the past which emphasized an arbitrary angle of projection for examination of the accessory sinuses. That the "rule of thumb" which prevails in the omniscient practice of general radiography results in ignominious failure when applied above the fourth cervical vertebra has been amply demonstrated.

The most valuable anteroposterior view of the frontal sinuses is perpen-

dicular to the superoinferior diameter. This projection also reveals the ethmoid cells, the sphenoid sinuses and a supplemental view of the maxillary sinuses. The same landmarks apply in placing the sagittal plane vertical and in determining the accuracy of the projection as in the anteroposterior view of the maxillary sinuses. In anteroposterior stereoscopic examinations of the accessory sinuses, the tube should be shifted in the sagittal plane

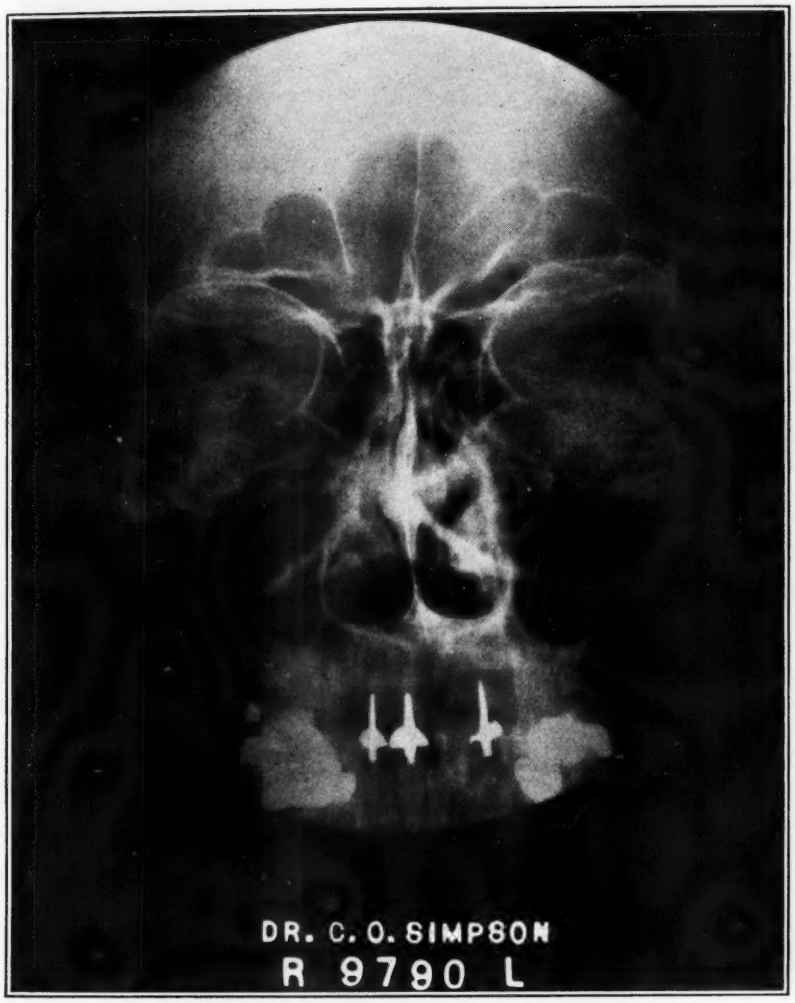


Fig. 7.—An anteroposterior view of the frontal sinuses.

instead of laterally, so the sagittal view will be maintained in each exposure. The stereoscopic examination should be preceded by one or more exposures to determine the most advantageous mean angle of projection from which to shift the tube.

The special examination for a vertical view of the sphenoid sinuses was introduced by Dr. George E. Pfahler, and is a marked improvement over the former methods of placing the cassette under the mandible or at the top of the head. The intraoral placement brings the cassette closer to the sphe-

**Fig. 8.—Position of patient, cassette, and cone for a special vertical examination of the sphenoid sinuses.**

**Fig. 9.—A vertical view of the sphenoid sinuses.**

noid region to produce sharper definition in the image than by other methods, and the technic is quite simple. Aside from the diagnostic value, this examination is particularly useful for operative purposes in showing the access, size and form of the sphenoids, and the location of the septum.

# *ABSTRACT OF CURRENT LITERATURE*

**Covering Such Subjects as**

**ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY**

**It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.**

**Insulin Treatment and Pyorrhea.** S. Zulkis (Berlin). Zahnaerztliche Rundschau, August 17, 1924, xxxiii, 33.

Diabetes mellitus is a disease which predisposes to suppurations and ordinarily we should expect to find pyorrhea a common and obstinate affection in the diabetic. The author has had personal experience with but one case of the double malady which he treated with insulin and suggests that this experience may open up new vistas in our knowledge of pyorrhea. The patient was a bank official aged 35 who for some months had presented symptoms which pointed to the presence of diabetes. He also presented typical pyorrhea alveolaris. Sugar in the urine amounted to over 5 per cent. He was placed at once on the ambulant insulin treatment but without the slightest attempt at local treatment of the gums. Under from fifty to sixty daily units of insulin the sugar excretion abated and with it the acidosis. Coincidentally the general state began to mend and with it the condition of the gums. As the treatment progressed and the sugar and acidosis vanished, the state of the gums also became normal. There were no loose teeth. In view of the outcome of this case one can hardly visualize pyorrhea as due to a precocious atrophy of the alveolus but rather as a disease of predominantly internal origin, to be reached by medical treatment.

**The Normal and Pathologic Anatomy of the Sella Turcica as Revealed by Roentgenograms.** J. D. Camp (Mayo Foundation). The American Journal of Roentgenology, etc., August, 1924, xii, 2.

The author's conclusions are in part as follows: Unless great care is exercised roentgenograms of the sella will present false defects and anomalies. The normal sella itself shows a wide range of variation although these should be recognizable; they fall under three heads according to basic shape: oval (60 per cent), round and flat. The size of the sella also exhibits great variations which complicated the diagnosis of early pathologic changes. The anteroposterior diameter may be as small as .5 cm. while the maximum is about 1.6 cm. and the depth measure likewise varies from 0.4 to 1.2 cm. The average dimensions as deduced by the author amount to

length 1.06 cm. and height 0.81 cm. Normal variations in the shape of the clinoid processes are not uncommon and in about 5 per cent the anterior and posterior clinoids are united to bridge the sella. It is possible to distinguish between intrasellar and extrasellar tumors because in each sort there are characteristic deformities but extrasellar growths cannot be diagnosticated by sellar deformity alone. The roentgenogram cannot bring out all of the destruction effected in every case as shown by comparison with autopsy finds.

**New Researches into the Reimplantation of Teeth.** A. Loos (Prague). Vierteljahrsschrift für Zahnheilkunde, 1924, xl, 2-3.

The author has studied this subject under roentgen control with special reference to fixation methods. His personal experience extends to 156 patients and in 41 of the cases he removed the periodontium and had 11 failures. In the other 115 the periodontium was left intact and the number of failures was but 3. As the series of 41 cases was imperfectly followed up, the ultimate success is not known in 30 of the cases, none of whom was seen after the first two weeks; hence the total failures may be far more than 11, but the latter number is certain. At the same time all 30 of these patients may have been satisfied with the outcome.

In cases that could be controlled the patient was able to chew in from fourteen to eighteen days and chew well in a month. Postoperative pain, swelling, etc., were present in a small number of cases, requiring heat and pyramidon or other sedative. In regard to the life of an implanted tooth this is a matter of uncertainty. In individual cases the tooth has been found intact after twenty-six years and at any period within this limit. At the same time the root absorption which takes place makes the survival very uncertain. Excluding teeth that work loose at a very early period, they may come away in two or three years and be passed by the bowel.

In regard to the history of the subject the modern transplantation of teeth dates back a quarter of a century, about which time many authors began to report series of cases. In other words the discovery of radiography was necessary to give a fresh impetus to an old subject. Half a dozen dentists of continental Europe within a few years published several hundred cases of their own or collected from literature, and the percentage of failure admitted was relatively low. Very few recent British or American authors are quoted.

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# *EDITORIALS*

## Nomenclature

IN this issue of the Journal appears a report of the Committee on Nomenclature adopted by the Eastern Association of Graduates of the Angle School of Orthodontia in May, 1924.

As stated in the report, the subject matter presented was prepared by Milo Hellman, the Chairman of the Committee. The report is very painstakingly prepared and presents the subject in a very clear and concise manner.

Reasons are given for the suggestion of certain terms. The majority of terms suggested are very good and overcome some of the difficulties which have been encountered by previous committees. However some of the best terms suggested are not made an official part of the report for as stated,

"They are just mentioned for the purpose of indicating the loose manner in which our terms are dealt with." *Teething* is suggested to describe or refer to the eruption of the teeth. *Dental arches* means the arrangements of the teeth.

In regard to the use of the term "dental arches," we find there is probably no term in orthodontia that has been so much abused or confusingly used as the term "arches." A few years ago the Committee on Nomenclature of the American Society of Orthodontists suggested that the word arches be used to describe the arrangements of the teeth or to refer to the teeth as arranged in the maxilla and mandible; which suggestions follow the same place outlined by the Committee of the Eastern Association of Graduates of the Angle School. We refer to this particular term because it has been so customary among orthodontists to use the word "arch" in referring to a regulating appliance. We would often be confronted with a sentence in which the word arch would be used with two different meanings, namely, "the expansion arch was used to expand the arch." The first term "arch" referring to appliance and the second term referring to the arrangement of the teeth. The report of the committee in question also wisely spent considerable time in studying the definition of "mastication" and "chew." Many have considered these terms to be synonymous and while neither one, so far as we know, is used to describe any other condition; we do not see that it makes any great amount of difference as to which one is used.

The committee divides mastication into two parts; namely, a "positive" and "negative stroke." This part of the report is also good but we believe from a further consideration of the report that the committee has to a certain extent fallen into the same error that other committees have, namely; in trying to confuse occlusion with mastication, if not confuse at least to associate.

Occlusion is a condition, a relation, a something that exists; the word should always be used as a noun. Mastication is an act or several separate acts, and while it is true that the direction and the movement of the mandible, and it is a fact the nature of the "positive" and "negative stroke" will depend upon the occlusion, we should not consider occlusion as being associated with mastication, as does the committee in describing "functional occlusion." Functional occlusion is described as "that form of occlusion which obtains at the end of the positive stroke of mastication, just before the negative stroke is begun." This definition is probably given because the committee introduced a new term "abocclusion." The definition of "abocclusion" is as follows: "The relation of the teeth of a dentition in which the mandibular teeth are not in contact." To our mind this definition is absolutely useless, and could be avoided by a slight change in the definition of occlusion so as to make occlusion read as follows: "The relation of the mandibular teeth of a dentition to the maxillary teeth."

The report of the Committee of the Eastern Association of Angle Graduates insists upon defining occlusion as the "relative position of the teeth of a dentition in which the mandibular teeth are in contact with the maxil-

lary teeth." The fact that the committee insists upon occlusion referring to teeth in contact makes it necessary to introduce the term "abocclusion" because the report of the committee says, "in certain flesh eating mammals the maxillary and mandibular premolars are never in contact." We presume that the committee refers to occlusal contact as being a distinct position from proximal contact. We can see no reason that the term occlusion should be so limited in describing the relation the teeth of one arch bear to those of the other as to make necessary the new term, abocclusion. The term occlusion describes perfectly such conditions as the committee tries to place under abocclusion.

In describing the occlusal contact relations of the teeth of man, the committee has very nicely illustrated the contact relations which go to make up the occlusion of the teeth of man, as follows: First, the surface contact. Second, cusp and fossa contact. Third, ridge and embrasure contact, and fourth, ridge and groove contact. However, there are grounds for confusion when the committee suggests that these occlusal contact relationships may be termed "factors of occlusion" because of the possibility of the students confusing "factors of occlusion" with "forces of occlusion" which has had an accepted usage in orthodontic literature for a number of years.

The plan used in describing normal occlusion involves a large amount of mathematics and would make it necessary for one to understand a system of calculation such as is followed by the editor of the report to be able to interpret the definition of normal occlusion. To our mind it seems as if the terms "normal occlusion," "inferior normal occlusion" and "superior normal occlusion" are going to create much more confusion than some of the definitions which the report of the committee tends to displace. However, with the type of dental education which is being advocated by the National Educational Council in which the dental students are to be taught almost everything except dentistry, it is very possible that a larger course of mathematics may be included to enable the student to understand the difference between inferior normal occlusion and superior normal occlusion.

The report of the Eastern Association of Graduates of the Angle School is one which has been prepared as the result of the great amount of study and deliberation, and is more satisfactory than any report which has been presented along similar lines. The report, with the objections given, we recommend for the careful study of our readers.

---

## Modern Practice of Tooth Extraction*

A VERY well written volume, more like a story than a textbook. There are details upon the preoperative and the postoperative care of the patient, which are timely. However, some of the suggestions and certain medication are now obsolete.

There is a marked similarity to a former publication by Dr. Lederer, even though the author claims, "the volume is based solely upon his own

*Modern Practice of Tooth Extraction, By Lester Richard Cahn, D.D.S., Macmillan Co., New York, 132 pages, 29 illustrations. Price $1.75.

experiences and ideas, also the operations described have been evolved by him.'' The author seems to have very little time for use of nitrous-oxide and oxygen. This is unfortunate as most of the best practitioners today in exodontia, depend upon gas-oxygen to accomplish their best results.

The chapter devoted to vaccine-therapy is of interest but is too little understood, as yet, to recommend to the student.

There are some errors in orthography through the volume which no doubt are typographical.

---

### Us Kids Have All the Trouble

I'm just a kid with crooked ivories, a little out of line,
Not enough to cause the worries, that I'm havin' at this time.
Just one or two a-stickin' out, a little bit too far,
But our dentist says without a doubt, my mug they surely mar.

So ma and dad have taken me, before it is too late,
Never listenin' to my plea a few more months to wait,
To the darn ole orthodontist, with wire, an' rope, an' bands,
Who will try his darndest, accordin' to his plans.

To pull 'em out in better shape, he's a-goin' to try,
Says I look like ''ole Darwin's ape,'' I wonder who's that guy.
So now my trap's all bound and tied, like Houdini in the show,
An' when I open it real wide, you can see its golden glow.

The kids who live upon our street, all josh when I appear,
To see my mouth it is a treat, an' call me ''mamma's dear.''
With a thousand little jiggers, all pullin' their own way,
This orthodontist figgers, he'll have 'em straight some day.

And although it is an awful bore, to go just after school,
To spend a half an hour or more, bein' picked at with some tool,
I suppose my ma an' dad are right, the orthodontist too,
As who would want to be a sight, like ole Jocko in the zoo.

So bet your boots you're findin' me, a-keepin' every date,
As I don't want my teeth to be a-stickin' right out straight.
I want 'em tucked right up in place, an' even to the line.
So I won't have a baboon face, an' worry all the time.

—*James T. Walls.*

# *ORTHODONTIC NEWS AND NOTES*

### Chicago Dental Society Midwinter Clinic and Meeting

January 21, 22 and 23, 1925, are the dates on which the Chicago Dental Society will hold its annual midwinter clinic and meeting at the Hotel Drake.

The program is practically completed. It covers all phases of dentistry, and will appeal to the specialist as well as to the general practitioner. Many men, new to Chicago Society audiences, will appear in the scientific and technical sections.

More exhibit space has been reserved than ever before, which insures a most comprehensive display of dental equipment and merchandise.

All members of the American Dental Association are cordially invited to attend. Reduced railroad rates will be available.—M. M. Printz, Secretary, 25 E. Washington Street.

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### American Society of Orthodontists

The Twenty-fourth Annual Meeting of the American Society of Orthodontists will be held in the new Atlanta-Biltmore Hotel, at Atlanta, Ga., April 14, 15, 16 and 17, 1925. (Mark off the date now.)

Walter H. Ellis, Sec'y-Treas.,
397 Delaware Avenue,
Buffalo, N. Y.

Clinton C. Howard, President,
Doctors Building,
Atlanta, Ga.

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### New York Society of Orthodontists

The regular meeting of the New York Society of Orthodontists was held at the Vanderbilt Hotel, October 8, 1924. The meeting was called to order by the President, Henry C. Ferris, after which the usual business was transacted.

Frederick L. Stanton assisted by Otto U. Sorenson gave a clinic entitled "A New Pantographic Surveyor and a New Occlusograph with Reports of Two Cases Using the Predetermined Arch, etc."

Jacob Stahl gave a brief description of a Photographic Unit for Orthodontists, which consists of a clinical camera as designed by the Eastman Company. He also called attention to the measurements of the Facial and Cranium using the instrument designed by B. E. Lischer.

Then followed a discussion by the members of the Society in which they described the usual cases and conditions which they had met in practice.

A clinic was presented by Jos. D. Eby and Edw. Kennedy entitled "Restoration of Dental Function and Facial Appearances by Orthodontic Preparation and Bone Graft, to Mandible from Crest to Ilium" (to be followed by Prosthesis), which was discussed by George Semken. Semken did the bone graft operation and Eby did the orthodontic work.

Harold S. Vaugh gave a discussion and a brief review of the "Labium Frenum in Its Relation to Malocclusion and Its Treatment."

The usual dinner was served to the members of the Society and guests. The dinner was followed by a paper by Royal S. Hayes entitled "Mechanics in Relation to Children." This paper dealt with function as a factor in development. The meeting adjourned.

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The midwinter meeting of the New York Society of Orthodontists will be held the afternoon and evening of Wednesday, December 10, 1924, at the Hotel Vanderbilt, Park Avenue and Thirty-fourth Street, New York City. A cordial invitation is extended to all general practitioners interested in Orthodontics.

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Dr. Emmett O'Neill is specializing in eliminating diseased conditions of the mouth as factors in systemic disease and is limiting his practice thereto. Medical Arts Building, 16th and Walnut Streets, Philadelphia, Pa.

Dr. Frederick Lester Stanton announces the removal of his office to 121 East Sixtieth Street, New York, N. Y.

Dr. Erwin Henselmeier announces the removal of his dental office from St. Louis to Suite 804-5 Brockman Bldg., Seventh Street and Grand Avenue, Los Angeles, Calif.

Dr. E. C. Glitzke wishes to announce the removal of his office from Suite 511, Grand Avenue Temple Bldg., to Suite 733, Rialto Bldg., Kansas City, Mo.

Dr. John Oppie McCall announces the removal of his offices to 100 West 59th Street, New York City. Practice limited to periodontia, oral diagnosis and dental radiography.